ADDENDUM NO. 2
TO
BLAZON NO. 1 MINE
DRAINAGE STUDY

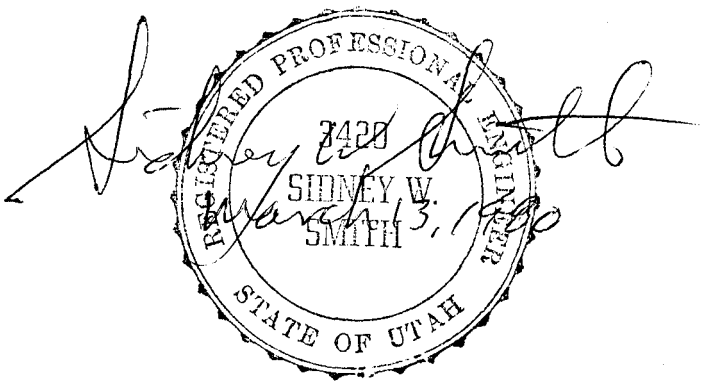
March 10, 1980

A site drainage study for the Blazon No. 1 Mine site was completed in July 1979, and an addendum was added in February 1980. In order to insure complete compliance with the Federal Surface Mining Regulations, a few alterations have been made in the drainage system design. These changes are outlined in the second addendum to the original report.

A relocation of some of the surface mine facilities has caused an increase in the disturbed site area to 1.4 acres. For a 10-year, 24-hour storm with an intensity of 0.10 in/hr and a "C" value of 0.6, the expected runoff from the site is 0.084 cfs. The Federal Surface Mining Regulations require that the entire runoff from this 24-hour storm be detained in the sedimentation pond. Although it is believed that an 8-hour detention time is adequate for this system, the ponds have been designed for the 24-hour detention in order to avoid the need for special approval by the regulatory authority. The detention volume required for a 24-hour storm is 7300 cubic feet; this volume is provided for in the two ponds in excess of the permanent water level. A freeboard of one foot is provided for above this detention storage.

Provision has been made in the pond design for a three-year sedimentation accumulation, as required by Federal regulation. A total volume of 6100 cubic feet in the bottom of the two ponds is provided for this purpose. This is based on a volume of 0.1 acre-feet of storage for each acre of disturbed drainage area. The disturbed site area is 1.4 acres.

The revised pond dimensions and features are shown on the detail sheet. These adjustments should bring the system into full compliance with federal regulations.



The Land Group

Landscape Architects, Engineers ASLA ACEC
Suite 304 • 205 West 700 South • Salt Lake City, Utah 84101 • (801) 364-1881

ADDENDUM NO. 3

TO

BLAZON NO. 1 MINE

DRAINAGE STUDY

March 14, 1980

A site drainage plan has been proposed to control the storm water runoff at the Blazon No. 1 mine site in Carbon County, Utah. The plan was originally described in a drainage study report in July 1979, and alterations have been noted in subsequent addendums. The purpose of this addendum is to describe and clarify a few more alterations in the design.

The following changes have been made in the drainage system design and are shown on the accompanying revised plans:

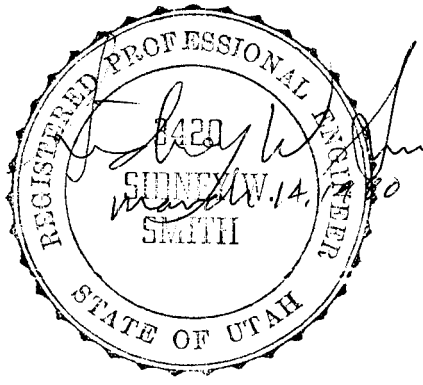
1. The drainage ditches around the South end of the site have been re-routed so as to prevent runoff from non-disturbed areas from going through the sedimentation pond system. The ditch location has also been changed above the portals to go above the storage tank, in order to include the area around the tank in the disturbed area.

2. The small section of road connecting the upper and lower portions of the site will be graded such that runoff therefrom will be routed through the sedimentation pond system.

3. A berm has been added to the road cross section as required by federal regulation.

4. The Little Snider Canyon drainage area, labelled area "C", has been added to the drainage area map. This area was used for runoff calculations described in Addendum No. 1.

These alterations in the plans should render the Blazon No. 1 drainage system environmentally sound and in compliance with federal regulations.



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Addendum

to

Blazon No. 1 Mine
Drainage Study

February 25, 1980

Since the completion of the Blazon No. 1 Mine site drainage study in July 1979, there have been considerable changes in the location of the surface facilities. Thus requiring some alteration in the drainage system design. These changes are outlined in this addendum to the original report.

The locations of the surface facilities are shown on Site Plan B. The effect of these changes is the extention of the mine site farther down the canyon. This has caused a relocation of the drainage ditches, culverts, and sedimentation ponds. There have also been two major changes in the storm retention pond, previously located at the upper end of the site, and the addition of a culvert to carry the runoff from Little Snider Canyon across the site.

The storm runoff from Little Snider Canyon was evaluated using the Rational Method, as described in the original drainage report. The drainage basin, which is north of and adjacent to, drainage area A, has an area of 112 acres. Using a coefficient of imperviousness of 0.20, and a time of concentration of 15-minutes, the maximum flow rate from the canyon, for a 10-year frequency storm, is estimated to be 33. cubic feet per second (cfs). This is based upon a storm intensity of 1.48-inches per hour. A 24-inch CMP culvert will be adequate to carry this flow; the mine site area above the culvert will be graded so that a larger storm would not cause considerable damage to the site.

These few changes should once again render the storm drainage system workable and safe.

Feb 28, 1980

REGISTERED PROFESSIONAL ENGINEER
3428
STANLEY W.
SMITH

SCOTT M. MATHESON
Governor

GORDON E. HARMSTON
Executive Director,
NATURAL RESOURCES

CLEON B. FEIGHT
Director

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

October 22, 1979

Mr. Joe Harvey
Blazon Mining Company
P.O. Box 327
Ferron, Utah 84523

Re: Blazon #1 Mine
Blazon Mining Company
Carbon County, Utah
ACT/007/021

Dear Mr. Harvey:

The Division staff has reviewed the drainage study and amendments prepared for Sanders and Associates by Land Group Engineering for Blazon Mining Company. The following comments and suggestions are offered:

1. The sediment pond details and site map indicate that 0.9 acres will be draining into the pond facility. This area does not include the raw coal stockpile, truck loadout, and the office and truck scales. The site map does not indicate whether the undisturbed area will be diverted above the portal area. The Division's review indicates that the minimum area to be drained into the sediment pond is 1.6 acres (See map). The minimum size of the pond, which would be approvable is 0.35 acre-feet (See calculations).

2. The culvert design calculations are in error. When the rational equation is used, the rainfall intensity (in/hr) must be the peak or maximum intensity of the design storm for a period equal to the time of concentration for the watershed. When this is done the peak flow for the 100 year - 24 hour storm for the bypass culvert equals:

   gp = CiA = 0.2 * 1.097 * 2131 = 468 CFS

   For the Long Canyon culvert the peak flow equals:

   gp = CiA = 0.2 * 1.097 * 1245 = 273.15 CFS

These flows would require round CMP culverts, with headwalls, inlet control, and the ratio of head water to diameter equal to 1.0, with diameters of 108" and 84" respectively.

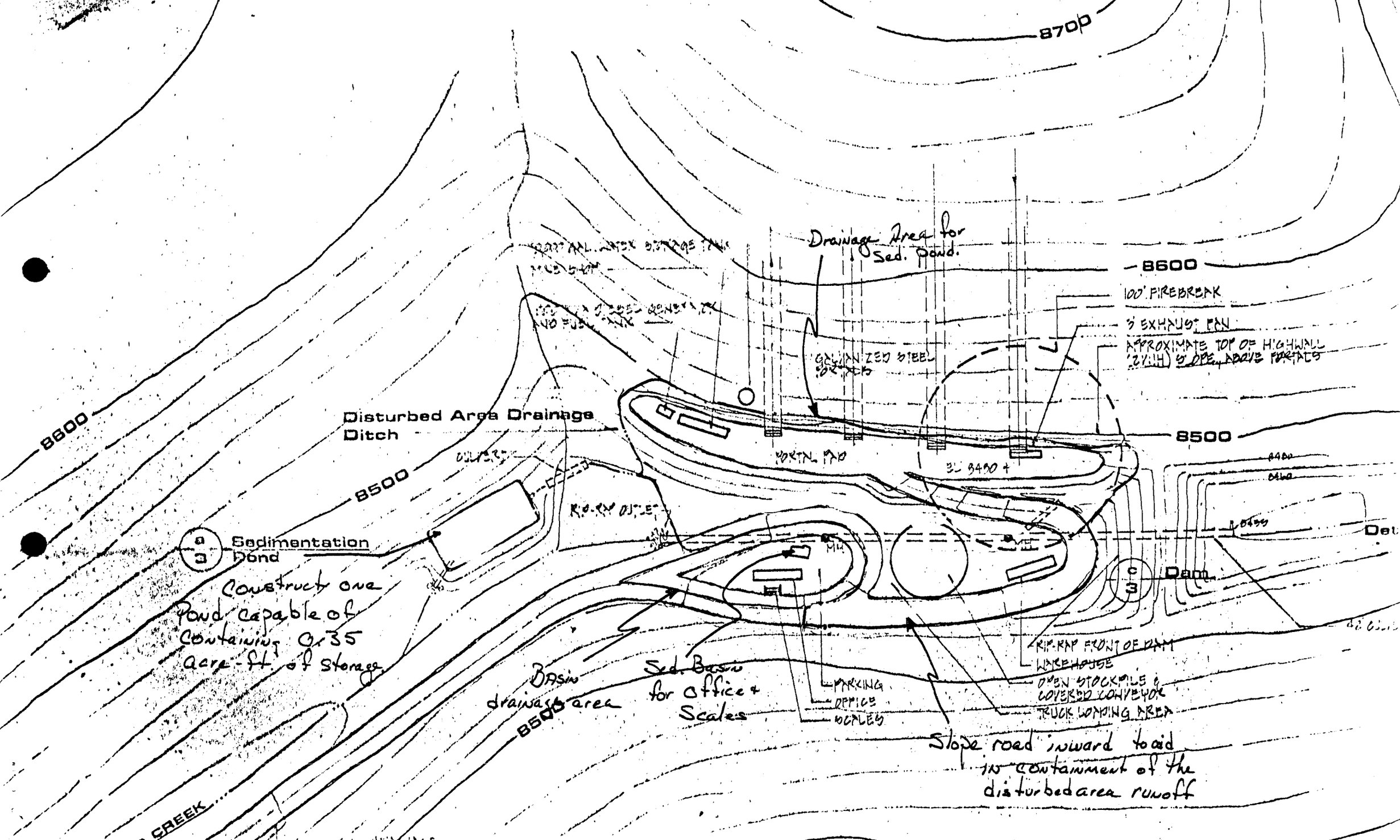
The Division requires that these minimum size structures or structrues capable of the same control be installed by Blason Mining Company. If there are any questions please contact the Division.

Sincerely,

Thomas J. Suchoski

THOMAS J. SUCHOSKI
RECLAMATION HYDROLOGIST

TJS/sp
Enc: Map and Calculations
cc: Sidney W. Smith, Land Group Engineering
Scott Williams, Sanders and Associates
John Hardaway, Office of Surface Mining


8700
8600
8500
8600
8500
8500
100' FIREBREAK
5' EXHAUST FAN
APPROXIMATE TOP OF HIGHWALL (2V:1H) SLOPE ABOVE PORTALS
Drainage Area for Sed. Pond.
Disturbed Area Drainage Ditch
PORTAL PAD
EL 8490 ±
RIP-RAP OUTLET
a 3 Sedimentation Pond
Construct one Pond capable of containing or 35 acre-ft of storage
Basin drainage area
Sed. Basin for office & Scales
c 3 Dam
RIP-RAP FRONT OF DAM
WAREHOUSE
OPEN STOCKPILE & COVERED CONVEYOR
TRUCK LOADING AREA
PARKING
OFFICE
SCALES
Slope road inward to aid in containment of the disturbed area runoff
CREEK

Location: BLAZON Mining Company
BLAZON #1 Mine

Precip. - 10yr-24hr = 2.40 in ; 25yr-6hr = 1.84 in.

AREA - Disturbed AREA 1.52 Acres
Undisturbed AREA 0 Acres
Pond AREA 0.062 Acres

CN - Disturbed 90
Undisturbed 70

Pond size -
Discharge Disturbed AREA 0.183 ac-ft
Discharge Undisturbed AREA 0 ac-ft
Direct precipitation 0.012 ac-ft
Sediment Storage 0.152 ac-ft

Total Storage = 0.347 ac-ft

Time of Concentration = 0.011 hrs

Peak flow -
Farmer-Fletcher 0.85 CFS
SCS 1.45 CFS

File

October 11, 1979

Mr. Thomas J. Suchoski
Reclamation Hydrologist
Division of Oil, Gas & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Blazon No. 1 Mine

Dear Mr. Suchoski:

We would like to supply the following information in answer to your letter to Mr. Joseph Harvey Blazon Company dated September 10, 1979 (see attached letter).

Your letter referred to a letter from the State Division of Water Rights which had several questions dealing with the proposed storm retention ponds.

After considerable discussion with Mr. Harvey and after our meeting this morning with you and Mr. Bob Morgan of the State Division of Water rights, we have decided to alter the plans.

We hereby amend the Drainage Study prepared for the Blazon No. 1 Mine prepared July 26, 1979. The portion of the plans and report concerning the sedimentation ponds and disturbed area drainage will remain the same except for minor changes to the outlet pipes to provide cut of collars and to retain 3 feet minimum water in the ponds at all times.

The changes in the plans and report are to change the 42 inch culvert under the storage and parking areas to a 48 inch culvert and to eliminate the storm retention facility. The 48 inch culvert will pass in excess of 85 cfs, which equals or exceeds the flow generated by a 1000 year 24 hour storm and also well exceeds the flow generated by a fast melt of the snow pack. See exhibit A of the report. The 48 inch culvert therefore passes all the major 24 hour storms and

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snowmelt runoff, and eliminates the need for the storm retention facility. Therefore no storm retention dam will be constructed. The entrance to the 48 inch culvert will be screened using mine rails and wire fence.

It should be noted that the culvert will not carry the 10-year 49 minute storms but the site will be graded such that the overflow will pass the 100 year 49 minute storm without danger to the mine portals or office area.

If you have any further questions please call me.

Yours truly,

Sidney W. Smith
P.E./L.S.

encl

SWS/sj

ADDENDUM NO. 1

TO

BLAZON MINE

FILL SLOPE STABILITY STUDY

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS

R&M

May 11, 1981

R&M No. 161009

Joe Harvey
Blazon Mine
Clear Creek, UT 84538

Dear Joe,

Attached please find two sets of the addendum to the report "Blazon Mine Fill Slope Stability Study" prepared by R&M Consultants, Inc. on April 23, 1981. Preparation of this addendum was authorized per your verbal request on April 30, 1981.

This addendum has addressed design and construction requirements in various aspects to meet state and federal regulations regarding the proposed mine waste from Blazon No. 1 Mine to be placed in the valley area. A drawing showing the design and construction specifications for the proposed fill is included in this addendum.

We appreciate the opportunity of providing the engineering services to you on this project and will be happy to answer any questions you may have concerning this project.

Sincerely,

Larry Migliaccio, P.E.
Director

CW

cc: Lee Rowley/Boyle Engr.
Lee Spencer/Div of Oil, Gas & Mining

ADDENDUM NO. 1

TO

BLAZON MINE

FILL SLOPE STABILITY STUDY

This addendum is prepared as a supplement to the report "Blazon Mine Fill Slope Stability Study" dated April 23, 1981, prepared by R&M Consultants, Inc., hereinafter referred to as "the report", to ensure compliance with state and federal regulations regarding the proposed fill of mine spoil to be disposed in the area as discussed in the report.

Type of Fill

The proposed fill area is located north of the portal bench immediately below the upper approach roadway, at the mouth of Little Snider Canyon (Drawing No. 1). The side slope at the steepest point of the existing valley in the proposed fill area has exceeded 20°, while the profile slope has exceeded 10°; and according to state and federal regulations, the proposed fill should be classified as valley fill. The design and construction of the proposed fill, therefore, must satisfy the requirements for valley fill as discussed below.

Stability of Fill

The slope stability of the proposed fill has been investigated in the report with the most critical factor of safety conforming to federal regulations.

Drainage Requirements

According to the hydrological data compiled in the report "Blazon No. 1 Mine Drainage Study," dated July 26, 1979, prepared by Land Group Engineering of Salt

Lake City, Utah, the intensity of precipitation for a 100-year, 24-hour storm based on statistics of local weather is 0.15 inch/hour. Since the soils in the drainage area are moderately pervious covered with relatively thin vegetation, a coefficient of imperviousness of 0.2 was considered appropriate for computing surface runoff. The contributing drainage area was measured to be approximately 135 acres (see Plate I). Based on the "Rational Method", the total storm runoff can be computed by:

$$Q = CiA$$

where, Q = storm runoff in cubic ft per second,
C = coefficient of imperviousness,
i = intensity of precipitation in inches per hour,
A = contributing drainage area in acres.

With C = 0.2, i = 0.15 inch/hour, A = 135 acres, the total storm runoff that must be diverted from the proposed fill is 4.05 cfs.

The discharge capacity of the existing 24-inch CMP culvert, embedded under the existing roadways and the proposed fill area, is checked by Manning's formula as follows:

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

where Q = discharge of culvert in cfs,
n = roughness coefficient of culvert,
D = diameter of culvert in ft,
S = slope of culvert,
A = cross-sectional area of culvert in cubic ft.

With n = 0.022, D = 2 ft, S = 0.23, A = 3.14 cu. ft., the existing culvert can discharge a storm runoff of about 64 cfs. Hence, the existing 24-inch culvert is more than adequate in passing the 100-year, 24-hour storm required by state and federal regulations for valley fill.

We, therefore, recommend that no additional diversion structure or underdrain is required for the proposed fill, with the exception of an 8" CMP to handle water draining from the portal area. (See page 5 of this addendum.)

Design of Fill

A cross section through the fill along the existing valley showing the design of the proposed fill is presented on Drawing No. 1.

The topsoil of the upper 6 inches, if present, should be removed, segregated and stored on site. This topsoil should be re-used for surfacing the top and slopes of the proposed fill to promote growth of vegetation. Vegetation within limits of the proposed fill area should be cleared and grubbed to remove all organic material.

The fill should be graded to meet the existing contours. The surfaces of the fill should be planted with native vegetation to minimize erosion. The proposed fill shall be graded and restored to closely resemble the general surface configuration of surrounding terrain and blend into and compliment the drainage pattern of the surrounding terrain, and be reclaimed to be capable of supporting the approved postmining land use.

A rock buttress should be constructed at the toe along the entire length of the fill in lieu of a retaining wall. The use of the rock toe buttress will enhance stability of and drainage of excess water in the fill. Design of the rock toe buttress is shown on Drawing No. 1.

The mine waste and spoil to be disposed as the fill material should be free of organic substances, debris, frozen soils, and boulders exceeding 8 inches in size. The fill material should be compacted in 12-inch loose horizontal lifts to at least 90% of the maximum density determined by AASHTO T99-74.

The fill consisting of mine waste and spoil should be covered with 4 ft of the best available local non-toxic and non-combustible material following final grading. This material should be subjected to the same requirements and compaction standards as described above.

The top of fill should be graded no steeper than 1V:20H (5 percent) toward outslope. Cross slopes of 1 to 2 percent should be provided to minimize surface erosion in the direction toward outslope.

Construction Specifications

Specifications governing the construction of the proposed fill are also included on Drawing No. 1. These specifications are developed from recommendations contained in this report and from the requirements of state and federal regulations.

Construction Inspection

To ensure compliance with design and specifications, we recommend that the fill construction be inspected by a registered engineer experienced in the construction of earth and rockfill embankments. This inspection should be conducted at least quarterly throughout construction, and during the following critical construction periods: 1) removal of all organic material and topsoil; 2) placement of rock toe buttress; 3) placement and compaction of fill material; and 4) revegetation.

A copy of certified report associated with each inspection by the registered professional engineer should be submitted to the Division of Oil, Gas and Mining of the State of Utah within two weeks after each inspection certifying that the fill has been constructed as specified in the design approved by the Division. A copy of the report should also be retained at the mine site.

Degradation of Water

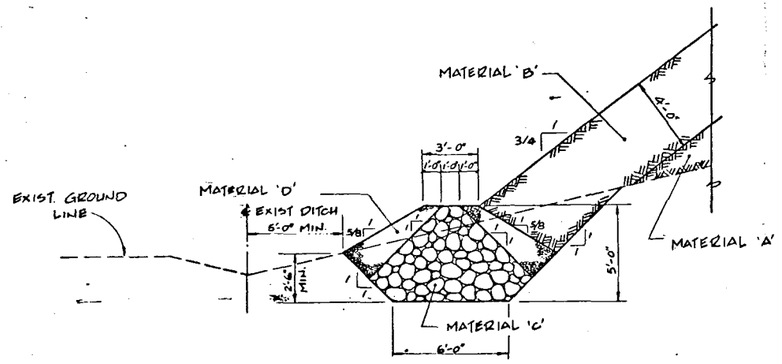
To our knowledge, no spring or water seepage has been observed within limits of the proposed fill area. Since a 4-ft cover of the best non-toxic local material available is recommended to be placed over the mine waste and surfaces of the fill are to be revegetated, degradation of surface and groundwater from fill runoff should

be negligible. However, it is necessary that the surface runoff from the disturbed area of the portal bench and the roadway above the proposed fill be drained into the sedimentation ponds before being discharged into the nearby creek, as would be other disturbed areas of the mining development plan. A major portion of solids carried down by runoff from all disturbed areas will thus be eliminated. For this reason, we recommend an 8-inch CMP be laid on the ground along the existing valley under the fill to divert the runoff from the portal bench and the roadway to the ditch of the lower roadway just below the toe of the fill, which will in turn discharge into the sedimentation ponds. An 8" CMP will pass a 10 year, 24 hour duration precipitation event for the portal area. 8" sizing calculations? Is this going to be a maintenance problem?

Prepared by:

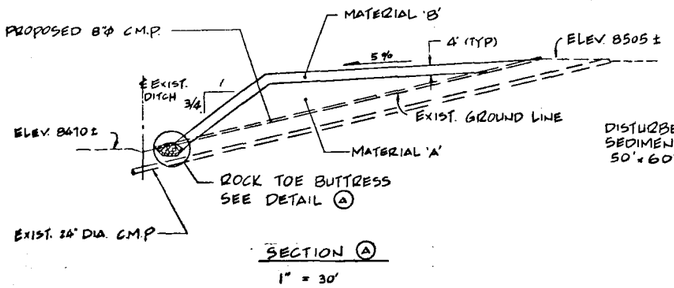
J.S. Liu, P.E., Ph.D.
Senior Geotechnical Engineer

Larry Migliaccio, P.E.
Director



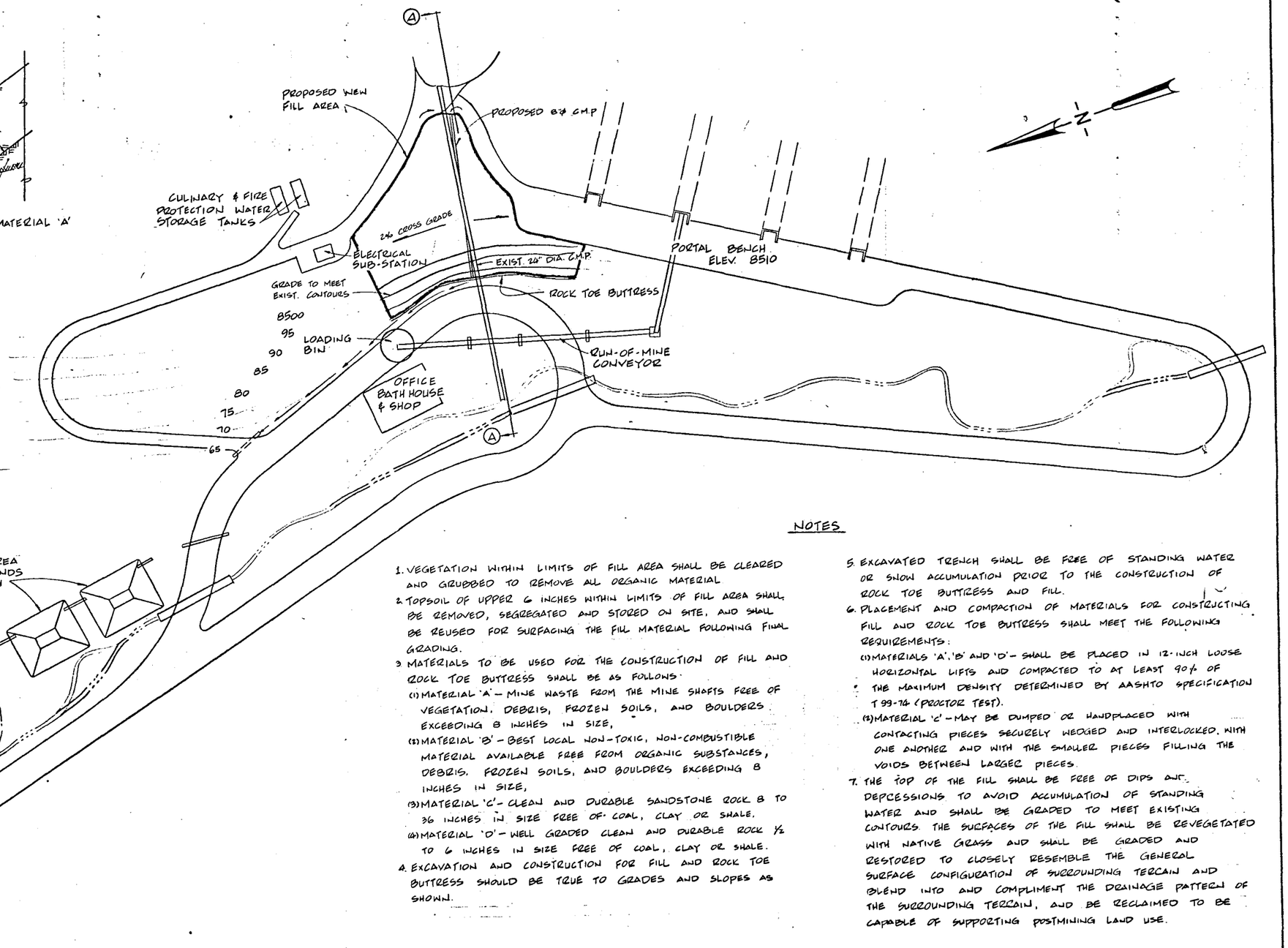
DETAIL Ⓐ — ROCK TOE BUTTRESS

1/4" = 1'-0"



SECTION Ⓐ

1" = 30'



NOTES

1. VEGETATION WITHIN LIMITS OF FILL AREA SHALL BE CLEARED AND GRUBBED TO REMOVE ALL ORGANIC MATERIAL
2. TOPSOIL OF UPPER 6 INCHES WITHIN LIMITS OF FILL AREA SHALL BE REMOVED, SEGREGATED AND STORED ON SITE, AND SHALL BE REUSED FOR SURFACING THE FILL MATERIAL FOLLOWING FINAL GRADING.
3. MATERIALS TO BE USED FOR THE CONSTRUCTION OF FILL AND ROCK TOE BUTTRESS SHALL BE AS FOLLOWS:
   (1) MATERIAL 'A' — MINE WASTE FROM THE MINE SHAFTS FREE OF VEGETATION, DEBRIS, FROZEN SOILS, AND BOULDERS EXCEEDING 8 INCHES IN SIZE,
   (2) MATERIAL 'B' — BEST LOCAL NON-TOXIC, NON-COMBUSTIBLE MATERIAL AVAILABLE FREE FROM ORGANIC SUBSTANCES, DEBRIS, FROZEN SOILS, AND BOULDERS EXCEEDING 8 INCHES IN SIZE,
   (3) MATERIAL 'C' — CLEAN AND DURABLE SANDSTONE ROCK 8 TO 36 INCHES IN SIZE FREE OF COAL, CLAY OR SHALE.
   (4) MATERIAL 'D' — WELL GRADED CLEAN AND DURABLE ROCK ½ TO 6 INCHES IN SIZE FREE OF COAL, CLAY OR SHALE.
4. EXCAVATION AND CONSTRUCTION FOR FILL AND ROCK TOE BUTTRESS SHOULD BE TRUE TO GRADES AND SLOPES AS SHOWN.
5. EXCAVATED TRENCH SHALL BE FREE OF STANDING WATER OR SNOW ACCUMULATION PRIOR TO THE CONSTRUCTION OF ROCK TOE BUTTRESS AND FILL.
6. PLACEMENT AND COMPACTION OF MATERIALS FOR CONSTRUCTING FILL AND ROCK TOE BUTTRESS SHALL MEET THE FOLLOWING REQUIREMENTS:
   (1) MATERIALS 'A', 'B' AND 'D' — SHALL BE PLACED IN 12-INCH LOOSE HORIZONTAL LIFTS AND COMPACTED TO AT LEAST 90% OF THE MAXIMUM DENSITY DETERMINED BY AASHTO SPECIFICATION T 99-74 (PROCTOR TEST).
   (2) MATERIAL 'C' — MAY BE DUMPED OR HANDPLACED WITH CONTACTING PIECES SECURELY WEDGED AND INTERLOCKED, WITH ONE ANOTHER AND WITH THE SMALLER PIECES FILLING THE VOIDS BETWEEN LARGER PIECES.
7. THE TOP OF THE FILL SHALL BE FREE OF DIPS AND DEPCESSIONS TO AVOID ACCUMULATION OF STANDING WATER AND SHALL BE GRADED TO MEET EXISTING CONTOURS. THE SURFACES OF THE FILL SHALL BE REVEGETATED WITH NATIVE GRASS AND SHALL BE GRADED AND RESTORED TO CLOSELY RESEMBLE THE GENERAL SURFACE CONFIGURATION OF SURROUNDING TERCAIN AND BLEND INTO AND COMPLIMENT THE DRAINAGE PATTERN OF THE SURROUNDING TERCAIN, AND BE RECLAIMED TO BE CAPABLE OF SUPPORTING POSTMINING LAND USE.

DESIGN JSL
DRAWN JKH
CHECK JSL
APPROVED EM

NO.	DATE	REVISION	BY	APRVD

BLAZON MINE NO. 1

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

MINE WASTE FILL
PLAN AND SECTIONS

DATE: 5-11-81
R&M NO. 1611009

DRAWING NO. 1

SHEET 1 OF 1

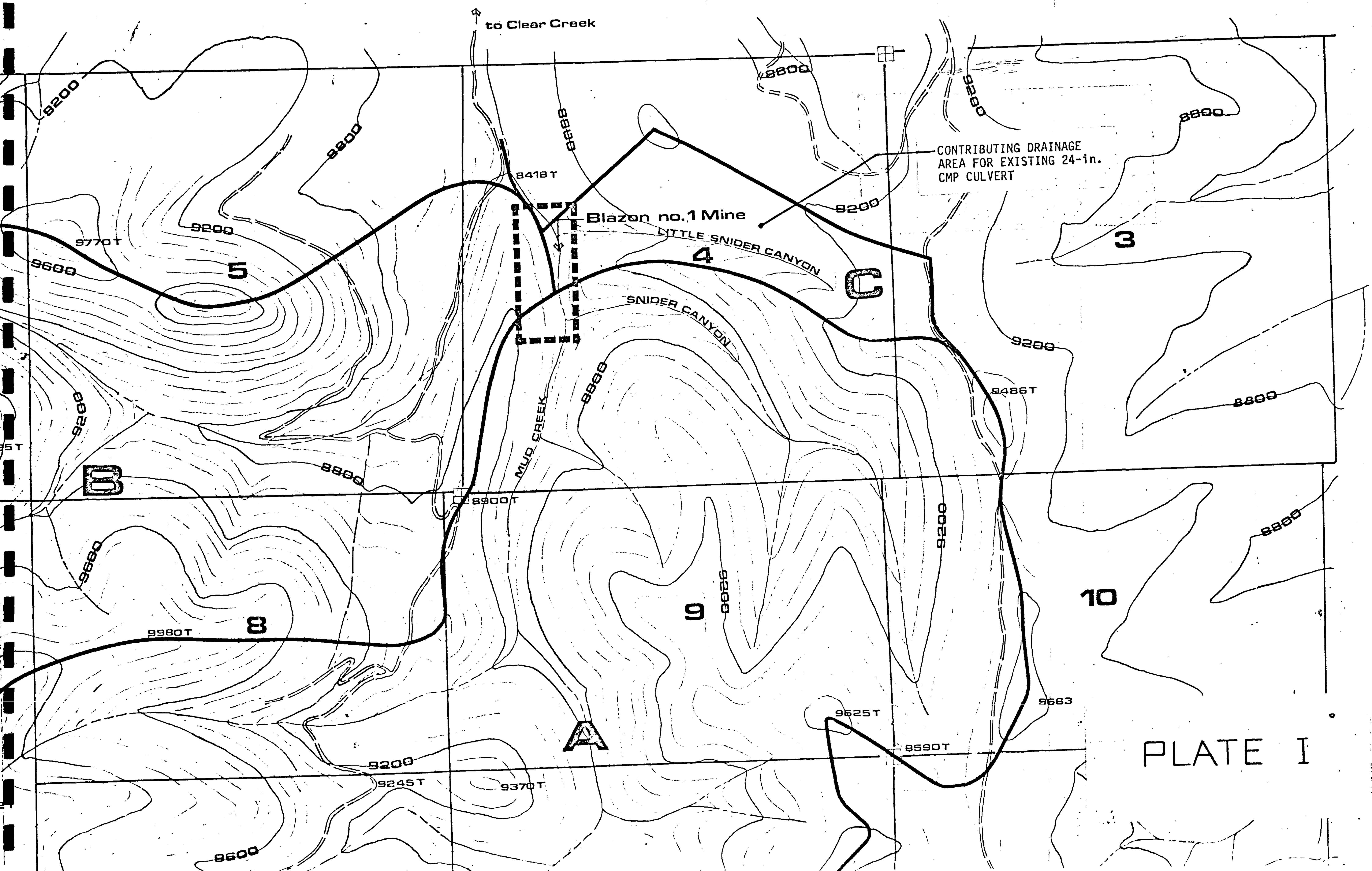
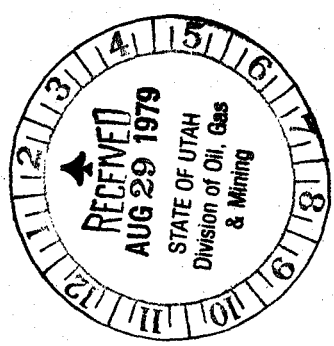

to Clear Creek
CONTRIBUTING DRAINAGE AREA FOR EXISTING 24-in. CMP CULVERT
Blazon no.1 Mine
LITTLE SNIDER CANYON
SNIDER CANYON
MUD CREEK
5
4
3
8
9
10
A
B
C
8418T
9770T
9980T
8900T
8486T
9625T
9563
8590T
9245T
9370T
9200
8800
9600

PLATE I

Blazon no.1 Mine

Drainage Study



prepared for
Sanders & Assoc.

Land Group Engineering
Engineers, Land Surveyors
suite 304, 255 W. 7th So. Salt Lake City, Utah

TABLE OF CONTENTS

ABSTRACT

A drainage study of the area surrounding the Blazon No. 1 Mine in Carbon County, Utah was done for Sanders and Associates. The results of that study are presented in this report.

July 26, 1979

STORM DRAINAGE STUDY FOR THE BLAZON NO. 1 MINE

Introduction

This report represents a study of the storm runoff and the proposed methods of controlling the runoff that passes through the Blazon No. 1 Mine site in Carbon County, Utah. Storm drainage from the site itself is also discussed.

Methods

The method used for calculating storm runoff is the "Rational Method", $Q = CiA$, where Q = storm runoff in cubic feet per second (cfs), C = coefficient of imperviousness, i= intensity of rainfall in inches per hour (in/hr), and A = contributing area in acres. This formula assumes that the maximum rate of runoff for a given intensity occurs when all parts of the drainage area are contributing. The values used for the various factors were obtained through the use of topography maps, study of the soils and vegetation, and statistics of local weather.

The coefficient of imperviousness used was 0.20. Although the terrain is fairly steep, the soils are moderately pervious, with some vegetation. The values for the rainfall intensity are based upon 10-year and 100-year return periods, with times of concentration, t_c, of 49 minutes and 45 minutes for areas A and B, respectively (see topography map, Appendix B). The time of concentration is based upon the distance between the most distant point and the design point, the difference in elevation between these points,

and the characteristics of the surface over which the water flows.

The contributing drainage area sizes are 2,131 acres and 1,245 acres for areas A and B, respectively. Snowmelt was calculated using a 260" snowpack at 10% moisture content with 75% runoff in a two and a half week period. These conditions approximate a 10 year storm. Using a coefficient of imperviousness of 0.80 yields the following:

$$\frac{\frac{260 \text{ in}}{12 \text{ in/ft}} \times 0.10 \times 2131A \times 43560 \text{ ft}^2/A}{18 \text{ days} \times \frac{24 \text{ hrs}}{\text{day}} \times \frac{3600 \text{ sec}}{\text{hr}}} = 129 \text{ cfs}$$

$$129 \text{ cfs} \times 0.75 \quad 0.80 = \underline{78 \text{ cfs}}$$

However, the runoff from area A for the 10 year - 49 minute storm is a much higher flow although much less total volume:

$$Q = (0.20)(0.74 \text{ in/hr})(2131 \text{ acres}) = \underline{315 \text{ cfs}}$$

This would require approximately an 84" diameter culvert. The recommended alternative is to use a 42" diameter pipe (with a capacity of 80 cfs at a 12 foot head) and a detention pond with a capacity of 650,000 cf (see drawing 2, Appendix B). The details of the dam are shown on drawing 3.

The 100 year - 24 hour storm at 65 cfs would be carried easily. The 1000 year - 24 hour storm at 85 cfs would also be carried with very little detention time.

The culvert carrying the Long Canyon (area B) flow was sized to carry the 10 year - 24 storm:

$$Q = (0.20)(0.10 \text{ in/hr})(1245 \text{ acres}) = \underline{25 \text{ cfs}}$$

This flow would require a 33 inch culvert with the down-stream bank of the road being protected with rip rap for the larger storm runoff overflow.

On site runoff is to be routed through a sedimentation pond system as shown on the site map (drawing 2). The details of the system are shown on drawing 3. The system is designed to carry the flow of a 10 year - 5 minute storm:

$$Q = (0.60)(2.3 \text{ in/hr})(0.9 \text{ acre}) = \underline{1.24 \text{ cfs}}$$

The size of each pond was determined using a 10 year - 24 hour storm and a detention time of eight hours.

$$Q = (0.60)(0.10 \text{ in/hr})(0.9 \text{ acre}) = \underline{0.054 \text{ cfs}}$$

$$\text{Vol} = Qt = 0.054 \text{ cfs} \times 8 \text{ hrs} \times 3600 \text{ sec/hr} = \underline{1555 \text{ cf}}$$

0.035 ac-ft

The inlet-outlet structures and transfer structure between the ponds are designed to minimize short circuiting with wiers in the ponds being designed to prevent any floating material such as oil from contaminating the effluent. The eight hour dentention time should be adequate to settle out all suspended solids.

Before any construction in the area is begun, a silt fence should be installed across Mud Creek at the location shown on the site map. The fence will retain any material that the stream picks up as it flows through the construction area. See drawing 3 for the silt fence details.

Conclusion

The storm runoff will be adequately controlled with little danger of flooding and the effects of the mining operation on the natural stream flow and water quality should be minimized.

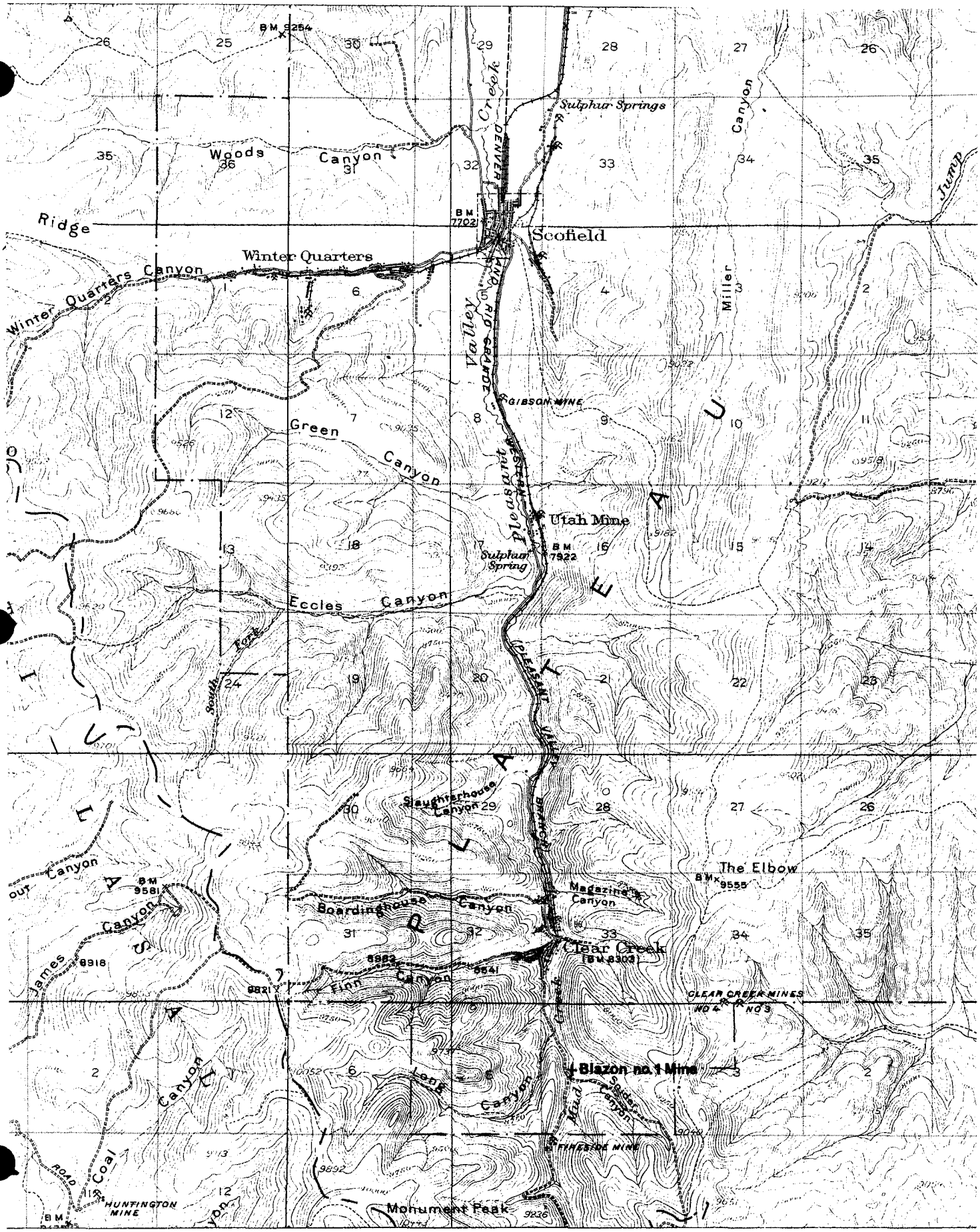
APPENDIX A

TABLE I

RUNOFF CALCULATIONS

AREA	STORM	C	i (in/hr)	A (acres)	Q (cfs)	CULVERT SIZE (Dia. in inches)
A	10 yr-49 min	0.20	0.74	2131	315	84
	10 yr-24 hr	0.20	0.10	2131	43	36
	100 yr-24 hr	0.20	0.15	2131	65	42
	1000 yr-24 hr	0.20	0.20	2131	85	48
	260" snowpack	0.80	n/a	2131	78	42
B	10 yr-45 min	0.20	0.77	1245	192	72
	10 yr-24 hr	0.20	0.10	1245	25	33
	100 yr-24 hr	0.20	0.15	1245	37	36
	1000 yr-24 hr	0.20	0.20	1245	50	42
	260" snowpack	0.80	n/a	1245	45	36

APPENDIX B

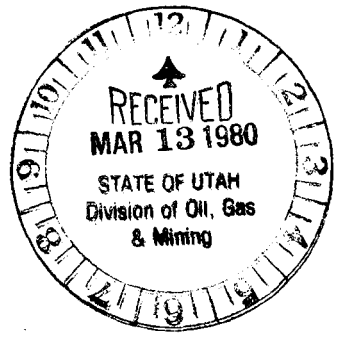


vicinity map

Soils & Vegetation

Blazon No. 1

Mine



SOIL SURVEY AND INTERPRETATIONS
PRELIMINARY VEGETATION SURVEY
for
Blazon Mining Company
March 11, 1980
Gary Moreau, District Conservationist
Earl Jensen, Soil Scientist
George Cook, Range Conservationist

The proposed Blazon Mine area is located one mile south of Clear Creek, Utah, in Carbon County. At the request of Joe Harvey representing Blazon Mining Company and the Price River Watershed Soil Conservation District, the Soil Conservation Service performed a soil survey on the proposed mining site. The survey was designed to comply with the Permanent Regulatory Program, Office of Surface Mining Reclamation and Enforcement, Department of Interior.

The soils included in the inventory cover approximately 25 acres of land near Mud Creek and Little Snider Canyons, Section 4, T. 14 S., R. 11 E., SLBM. The soils are shown on the attached map. Each soil is identified with a three letter symbol, and the pattern and extent denoted by the soil boundary lines on the map. All areas having the same symbol are essentially the same kind of soils. There may be small areas of included soils that are slightly different. The soils have not been named or correlated. When the overall county survey is completed, small areas may become inclusions in other map units. Immediately following the soil descriptions is a table pointing out limitations of the soils for a variety of uses.

The vegetation was analyzed using the range site methods of the Soil Conservation Service. Range sites are shown on the attached map. Only preliminary information was obtained before a light snow arrived in the survey area. Another field trip will be required to identify the low growing grasses and forbs, and therefore, to assess present vegetation, productivity, and range condition. Presented in this report are the range site delineations with potential productivity according to favorable and unfavorable precipitation years.

More detailed information is on file in the Price Field Office of the Soil Conservation Service.

SOIL LEGEND

Soil Symbol	Soil Mapping Unit Name
BIG	BI stony loam, 50 to 70 percent slopes
CIG	CI loam, 40 to 65 percent slopes
DIB	DI loam, 2 to 5 percent slopes

DESCRIPTIONS OF THE SOILS

BIG BI stony loam, 50 to 70 percent slopes

This BI soil is moderately deep and well drained. It occurs on very stony mountain sideslopes along Mud Creek at elevations of 2590 to 2680 meters (8500 to 8800 feet). This soil formed in colluvium and residium derived mainly from sandstone and shale.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. Slopes are 50 to 70 percent and east, west, and north facing. They are medium and long in length and concave-convex in shape.

Vegetation is dominantly aspen, Douglas fir, white fir, peavine, blue wildrye.

Included in mapping are small areas of rock outcrop near the foot of the slopes.

In a representative profile the surface layer is dark grayish brown stony loam about 8 centimeters (3 inches) thick. The subsurface layer is light yellowish brown stony sandy loam about 20 centimeters (8 inches) thick. The subsoil is pale brown and light brownish gray, very stony clay loam about 74 centimeters (29 inches) thick over sandstone at a depth of 102 centimeters (40 inches).

Permeability is moderately slow. Available water capacity is about 13 centimeters (5 inches). Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is about 102 centimeters (40 inches). Surface runoff is slow and erosion hazard is slight under potential native vegetation and very high if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range, wildlife habitat, and woodland.

Taxonomic classification is fine-loamy, mixed typic cryoboralfs.

A representative pedon of BI stony loam, 50 to 70 percent slopes was described near the proposed portal of Blazon Company Mine.

01—2.5 to 0 centimeter (1 to 0 inch); leaves and fir needles.

A1—0 to 8 centimeters (0 to 3 inches); dark grayish brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) when moist; moderate coarse granular structure; soft, friable, slightly sticky, slightly plastic; many very fine to large roots; 5 percent stones, 5 percent cobbles, 10 percent gravel; neutral reaction (pH 6.8); abrupt wavy boundary.

A2—8 to 30 centimeters (3 to 11 inches); light yellowish brown (10YR 6/4) stony sandy loam, yellowish brown (10YR 5/4) when moist; moderate coarse platy structure; slightly hard, friable, nonsticky, nonplastic; common very fine to medium roots; 5 percent stones, 5 percent cobbles, 10 percent gravel; neutral reaction (pH 6.6); clear smooth boundary.

B21t—30 to 61 centimeters (11 to 24 inches); pale brown (10YR 6/3) stony clay loam, brown (10YR 4/3) when moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; common very fine to large roots; common moderately thick clay films; 5 percent gravel, 5 percent cobbles, 10 percent stones; neutral reaction (pH 6.6); abrupt irregular boundary.

B22t—61 to 102 centimeters (24 to 40 inches); light brownish gray (10YR 6/2) very stony clay loam, dark grayish brown (10YR 4/2) when moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; common very fine to large roots; 10 percent gravel, 20 percent cobbles, 10 percent stones; mildly alkaline (pH 7.8); abrupt irregular boundary.

R—102 centimeters (40 inches); sandstone.

CIG CI loam, 40 to 65 percent slopes

This CI soil is moderately deep and well drained. It occurs on very steep mountain sideslopes on the east side of Mud Creek at elevations of 2560 to 2620 meters (8400 to 8600 feet). This soil formed in local colluvium and residium derived mainly from shale and sandstone.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature is 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. Slopes are 40 to 65 percent and west facing. They are medium and long in length and convex-concave in shape.

Vegetation is dominantly aspen, snowberry, blue wildrye, and native bluegrass.

Included in mapping are small areas of rock outcrop near the foot of the slopes.

In a typical profile the surface layer is dark brown loam about 10 centimeters (4 inches) thick. The underlying layer is brown, gravelly loam about 20 centimeters (8 inches) thick. The next layer is very pale brown, stony loam and stony clay loam about 66 centimeters (26 inches) thick. Depth to soft shale is 97 centimeters (38 inches).

Permeability is moderately slow. Available water capacity is 11 to 13 centimeters (4.5 to 5 inches) to a 97 centimeter (38 inch) depth. Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is about 97 centimeter (38 inches). Surface runoff is medium and erosion hazard is moderate under potential native vegetation and very high if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range and wildlife habitat.

Taxonomic classification is fine-loamy, mixed typic cryoborolls.

A typical pedon of CI loam 40 to 65 percent slopes was described in the excavation east of the junction of Long Canyon and Mud Creek.

A11—0 to 10 centimeters (0 to 4 inches); dark brown (10YR 4/3) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine, common medium and coarse roots; 10 percent gravel; neutral reaction (pH 6.8); abrupt wavy boundary.

A12—10 to 30 centimeters (4 to 12 inches); brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and coarse roots; 15 percent gravel, 5 percent cobbles; neutral reaction (pH 6.6); clear wavy boundary.

C1—30 to 81 centimeters (12 to 32 inches); very pale brown (10YR 7/3) stony loam, brown (10YR 4/3) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, and coarse roots; 15 percent gravel, 10 percent cobbles, 10 percent stones; slightly acid (pH 6.4); clear wavy boundary.

C2—81 to 97 centimeters (32 to 38 inches); very pale brown (10YR 7/3) stony clay loam, grayish brown (10YR 5/2) when moist; rock structure; very hard, very firm, very sticky, very plastic; few very fine and fine roots; 15 percent gravel, 10 percent cobbles, 10 percent stones; slightly acid (pH 6.4); abrupt smooth boundary.

C35—97 centimeters (38 inches); soft shale.

DIB DI loam, 2 to 5 percent slopes

This DI soil is very deep and moderately well drained. It occurs on flood plains and alluvial fans at elevations of about 2590 meters (8500 feet). This soil formed in alluvium derived mainly from sandstone, quartzite and shale.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature is 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. This soil occurs adjacent to Mud Creek.

Slopes are 2 to 5 percent and north facing. They are short in length and concave-convex in shape.

Vegetation is dominantly sedge, slender wheatgrass, and native bluegrass.

Included in mapping are small areas of poorly drained soils with wet meadow vegetation. These areas are located near the stream and may be flooded at times.

In a typical profile the surface layer is dark grayish brown loam about 71 centimeters (28 inches). The underlying layer is brown, very fine sandy loam 43 centimeters (17 inches) thick. The next layer is grayish brown, cobbly very fine sandy loam to a depth of more than 152 centimeters (60 inches). The water table is at a depth of about 114 centimeters (45 inches) for a short time in the spring.

Permeability is moderate. Available water capacity is 20 to 23 centimeters (8 to 9 inches) to a depth of 152 centimeters (60 inches). Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is more than 152 centimeters (60 inches). Surface runoff is slow and erosion hazard is slight under potential native vegetation and moderate if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range and wildlife habitat.

Taxonomic classification is fine-loamy, mixed cumulic cryoborolls.

A typical pedon of DI loam, 2 to 5 percent slopes was described near the stream bank of Mud Creek about 15 meters (50 feet) south of the junction of Little Snider Canyon and Mud Creek.

A1—0 to 8 centimeters (0 to 3 inches); dark grayish brown (10YR 2/2) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; common fine and very fine roots; neutral reaction (pH 6.6); clear smooth boundary.

A12—8 to 61 centimeters (3 to 24 inches); dark grayish brown (10 YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and very fine roots; neutral reaction (pH 6.8); abrupt smooth boundary.

A13—61 to 71 centimeters (24 to 28 inches); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; neutral reaction (pH 7.0); clear smooth boundary.

C1—71 to 114 centimeters (28 to 45 inches); brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, slightly sticky, nonplastic; 10 percent gravel; neutral reaction (pH 7.0); clear wavy boundary.

C2—114 to 152 centimeters (45 to 60 inches); grayish brown (10YR 5/2) cobbly very fine sandy loam, very dark brown (10YR 2/2) when moist; massive; soft, very friable, slightly sticky, nonplastic; 15 percent gravel, 20 percent cobbles; neutral reaction (pH 7.0).

SOIL INTERPRETATIONS AND LIMITATIONS**

Blazon Mine Survey Area

Use	Soil		
	CIG	BIG	DIB
Shallow Excavation	Severe—Slope	Severe—Depth to rock, slope	Slight
Local Roads and Streets	Severe—Slope	Severe—Low strength, slope	Moderate—Low strength, floods
Roadfill	Poor—Slope	Poor—Low strength, slope	Fair—Low strength, wetness
Topsoil	Poor—Large stones, slope	Poor—Large stones, slope	Good
Pond Reservoir Area	Severe—Slope	Severe—Slope	Moderate—Seepage, slope
Embankments, Dikes, Levees	Moderate—Thin layer, large stones	Moderate—Thin layer, piping, large stones	Severe—Piping
Seeding	Poor—Slope, large stones	Poor—Slope, large stones	Good

** Ratings are based on criteria in the National Soils Handbook, SCS, USDA

DESCRIPTION OF VEGETATION

The Blazon Mine site was visited late in the fall after the first snow had fallen. Present vegetation and productivity was not attained but will be recorded in early summer. Enough information was received to evaluate the sites for potential productivity according to range site analysis methods of the Soil Conservation Service. The following sites are keyed to the attached vegetation map.

Site A—Woodland Ecosystem—High Mountain Loam (Aspen)

This woodland community occurs on steep mountain slopes of 50 to 70 percent. Elevation ranges from 2590 to 2680 meters (8500 to 8800 feet). It occurs on all exposures but is primarily on the north and east in the survey area.

Climate is cool and humid with average annual precipitation ranging from 56 to 64 centimeters (22 to 25 inches).

Quaking aspen is the dominant overstory plant. Canopy density will vary from 25 to 70 percent, but is most common from 40 to 55 percent. Shade tolerant plants such as blue wildrye, bearded wheatgrass, mountain brome, nodding bluegrass, sweetanice, meadowrue and edible valerian are the dominant understory species.

Vegetation is an overstory of quaking aspen. The understory consists of approximately 60 percent grasses, 30 percent forbs and 10 percent shrubs and tree reproduction. Total vegetation is 40 percent aspen, 35 percent grasses, 20 percent forbs and 5 percent shrubs.

This woodland site relates to the BIG soil.

The following table lists the potential plant community for the high mountain loam (aspen) woodland site. These species have been identified on similar sites. Those occurring on the Blazon Mine site will not be known until after the 1980 summer field trip. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Nature of Potential Plant Community—High Mountain Loam (Aspen)

Species	Canopy Class: Sparse 25-50% %/wt	Med 51-65% %/wt	Dense 65% %/wt
GRASSES AND GRASS-LIKE			
Bearded wheatgrass	5	3	T
Blue wildrye	13	5	T
Columbia needlegrass	1	1	T
Dryland sedge	5	10	10
Kentucky bluegrass	1	5	10
Mountain brome	30	20	5
Nodding bluegrass	6	3	T
Nodding brome	1	1	T
Oniongrass	1	1	T
Slender wheatgrass	3	2	1
FORBS			
Aster	1	1	1
Bluebell	1	5	10
Butterweed	5	3	T
Cow cabbage	1	1	T
Descurainia	1	5	10
Edible valerian	5	1	-
Geranium	1	1	1
Horsemint	1	5	1
Jacob's ladder	2	1	-
Lupine	1	2	3
Meadowrue	1	5	5
Peavine	5	5	10
Poison vetch	1	5	5
Senecio	1	5	5
Stellaria	1	1	-
Sweetanice	6	3	-
Tall larkspur	1	5	10
Violet	1	2	5
Wild carrot	1	1	-
Western coneflower	1	5	15
Yarrow	1	5	5
SHRUBS AND TREES			
Chokecherry	1	2	5
Elderberry	1	1	-
Mountain ash	1	1	1
Oregon grape	1	1	5
Quaking aspen	*5 40	*5 50	*10 70
Rose	1	T	-
Serviceberry	1	1	-
Snowberry	1	5	10
Willow	1	1	5

* Production to 1.37 meters (4.5 feet) height

The following table shows the total annual production on air dry weight basis for a sparse canopy class of high mountain loam (aspen). This data is based on 162 plots taken in excellent condition, 373 plots in good condition, 410 plots in fair condition, and 83 plots in poor condition.

TOTAL ANNUAL PRODUCTION OF VEGETATION
For Sparse Canopy Class

	Total All Vegetation Kg/Ha	Total All Vegetation Lbs/Ac	Total Below 1.37m(4.5 Ft) Kg/Ha	Total Below 1.37m(4.5 Ft) Lbs/Ac
Favorable years	5,625	5,000	3,650	3,250
Average years	3,925	3,500	2,550	2,275
Unfavorable years	2,250	2,000	1,450	1,300

Site B—High Mountain Loam

This range site occurs on very steep mountain slopes. It is found on west exposures in the study area. The slopes are mostly 40 to 65 percent. The elevation ranges from 2560 to 2620 meters (8400 to 8600 feet).

The climate of the site is cool and humid with cold, snowy winters. The average annual precipitation varies from 56 to 64 centimeters (22 to 25 inches). Distribution of this moisture is generally 23 to 35 percent during the plant growing season. Thus, most of the effective moisture comes from snowmelt from winter precipitation.

Plant growth begins about May 10-20 and ends due to killing frosts about September 15 to October 1. Moisture and temperature are such that they are not limiting to plant growth during this period except some years a small moisture deficiency in July and August will slow down growth of herbage and may force grass and forb species into early maturity. The frost-free period is 50 to 90 days. Mean annual air temperature is 2 to 3°C (36 to 37°F).

This range site relates to the CIG soil.

The potential vegetative composition by weight is approximately 55 percent grasses, 25 percent forbs and 20 percent shrubs with a large total number of forb species. The following table shows major plant species and percentages of the total potential plant community by weight that each normally contributes. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Potential Plant Community—High Mountain Loam

Grass and Grass-Like Plants	Percent
Basin wildrye	5
Bearded wheatgrass	10
Blue wildrye	5
Columbia needlegrass	4
Idaho fescue	5
*Kentucky bluegrass	3
King's fescue	1
Letterman needlegrass	10
Mountain brome	16
Muttongrass	10
Nodding bluegrass	10
Nodding brome	1
Oniongrass	1
Prairie junegrass	1
Sedge	2
Sheep fescue	1
Slender wheatgrass	30
Tall bluegrasses	5

*Not a part of original climax vegetation, but has now established an ecological niche in the potential plant community.

Forbs	
Arrowleaf balsamroot	1
Aster	4
Astragalus	1
Bluebell	2
Butterweed	10
Columbine	1
Deathcamas	1
Edible valerian	1
Elk thistle	1
Eriogonum	1
Falsehellebore	1
Geranium	2
Horsemint	4
Indianpaintbrush	1
Jacob's ladder	5
Knotweed	1
Lewis flax	1
Little sunflower	3
Lomatium	4
Low larkspur	1

Forbs (Cont)	Percent
Lupine	2
Mulesear dock	3
Native clover	2
Others	5
Peavine	6
Penstemon	2
Phacelia	1
Senecio	1
Showy elkweed	1
Skeleton loco	1
Sneezeweed	2
Stoneseed	3
Sweetanice	2
Tapertip hawksbeard	1
Tall larkspur	2
Timber poisonvetch	1
Wild carrot	1
Yarrow	3
Shrubs and Trees	
Antelope bitterbrush	2
Big sagebrush	3
Bittercherry	2
Chokecherry	5
Currant	2
Elderberry	7
Mountain snowberry	7
Oregon grape	2
Serviceberry	3
Silver sagebrush	2
Snowbrush ceanothus	5
Threetip sagebrush	2
Wood's rose	1
Yellowbrush	3

No trees occur on this range site.

Vegetative cover by ocular estimate is 70 to 75 percent.

Plant species not apart of the climax plant community that are most likely to invade the site if plant cover deteriorates are annual grasses and annual forbs. When retrogression occurs, shrubs greatly increase primarily sagebrush species.

Potential yields from an excellent condition high mountain loam range site are shown in the following table. This yield data is based on 110 plots in excellent condition,49 plots in good, 154 plots in fair, and 30 plots in poor condition.

TOTAL POTENTIAL ANNUAL PRODUCTION OF VEGETATION
For Excellent Condition Class
High Mountain Loam Range Site

	Total All Vegetation	
	Kg/Ha	Lbs/Ac
Favorable Years	3360	3000
Median Years	2800	2500
Unfavorable Years	1324	1450

Site C—Semiwet Streambottoms

This site occurs on gently sloping and moderately sloping flood plains in canyon and small valley bottoms and along low benches adjacent to stream bottoms. There are many strongly sloping alluvial fans at the mouth of the tributaries. Slopes are generally 2 to 5 percent. Elevations are about 2590 meters (8500 feet).

The climate of this site is cool and quite humid with cold and snowy winters. The average annual precipitatiion varies 56 to 64 centimeters (22 to 25 inches). Distribution of annual precipitation is about 20 percent during the plant growing period (May to September), and about 80 percent during the non-growing period, as shown by the Snake Creek weather station records. In the spring and early summer months, a moderately deep water table drops during the late summer months and at this time the more shallow rooted plants are not affected by sub-irrigation.

Plants begin to grow about May 1 to June 1. During the hot and dry part of the summer, the grasses and forbs will become dormant. Some regrowth occurs after September 1, when sufficient moisture is available. Shrub species grow throughout the summer and until fall frosts. The optimum growth period of all plants is during May and June. The frost-free period is from 80 to 95 days which is near June 1 to September 15.

This range site relates to the DIB soil.

The vegetation of this site usually has a variable overstory of water-loving trees and shrubs of approximately 40 percent of the total production annually on an air dry basis. Grasses are about 45 percent of the plant composition and forbs 15 percent. The following table shows major plant species and percentages of the total potential plant community by weight that each normally contributes. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Potential Plant Community--Semiwet Streambottoms

Grasses and Grass-Like Plants	Percent
Basin wildrye	5
Bearded wheatgrass	10
Bluebunch wheatgrass	10
Blue wildrye	15
Bottlebrush squirreltail	1
Columbia needlegrass	2
Kentucky bluegrass	10
Letterman needlegrass	5
Mountain brome	10
Muttongrass	10
Needle and thread	5
Nevada bluegrass	5
Oniongrass	2
Rushes	1
Sedge	5
Slender wheatgrass	10
Redtop	5
Western wheatgrass	10
Wiregrass	1
Forbs	
Aster	1
Buckwheat	2
Butterweed	3
Cinquefoil	1
Common cowparsnip	5
Clover	3
Edible valerian	5
Geranium	5
Goldenpea thermopsis	3
Goldenrod	1
Herbaceous sagewort	2
Horsemint	5
Lambstongue groundsel	1
Showy goldeneye	5
Lupine	2
Peavine	5
Starry falsesolomonseal	1
Sweetanise	5
Yarrow	2

Shrubs and Trees	Percent
Big sagebrush	5
Bigtooth maple	1
Blue elderberry	2
Boxelder	5
Chokecherry	5
Currant	1
Dogwood cottonwood	15
Gambel oak	5
Mountain snowberry	5
Oregon grape	1
Quaking aspen	3
Rabbitbrush	1
Redosier dogwood	1
Rockymountain juniper	3
Serviceberry	3
Snowberry	3
Thinleaf alder	5
Virgins bower	2
Water birch	5
Willow	15
Wood's rose	1
Yellowbrush	2

Several water-loving tree species are found in scattered clumps or as single trees throughout this site. Boxelder, Fremont cottonwood, narrowleaf cottonwood, quaking aspen, thinleaf alder, Rockymountain juniper and water birch are present along with tall shrub species such as bigtooth maple, chokecherry, and several species of willow.

These overstory species have an overstory cover of 10 to 40 percent depending on distance from the water table or stream course.

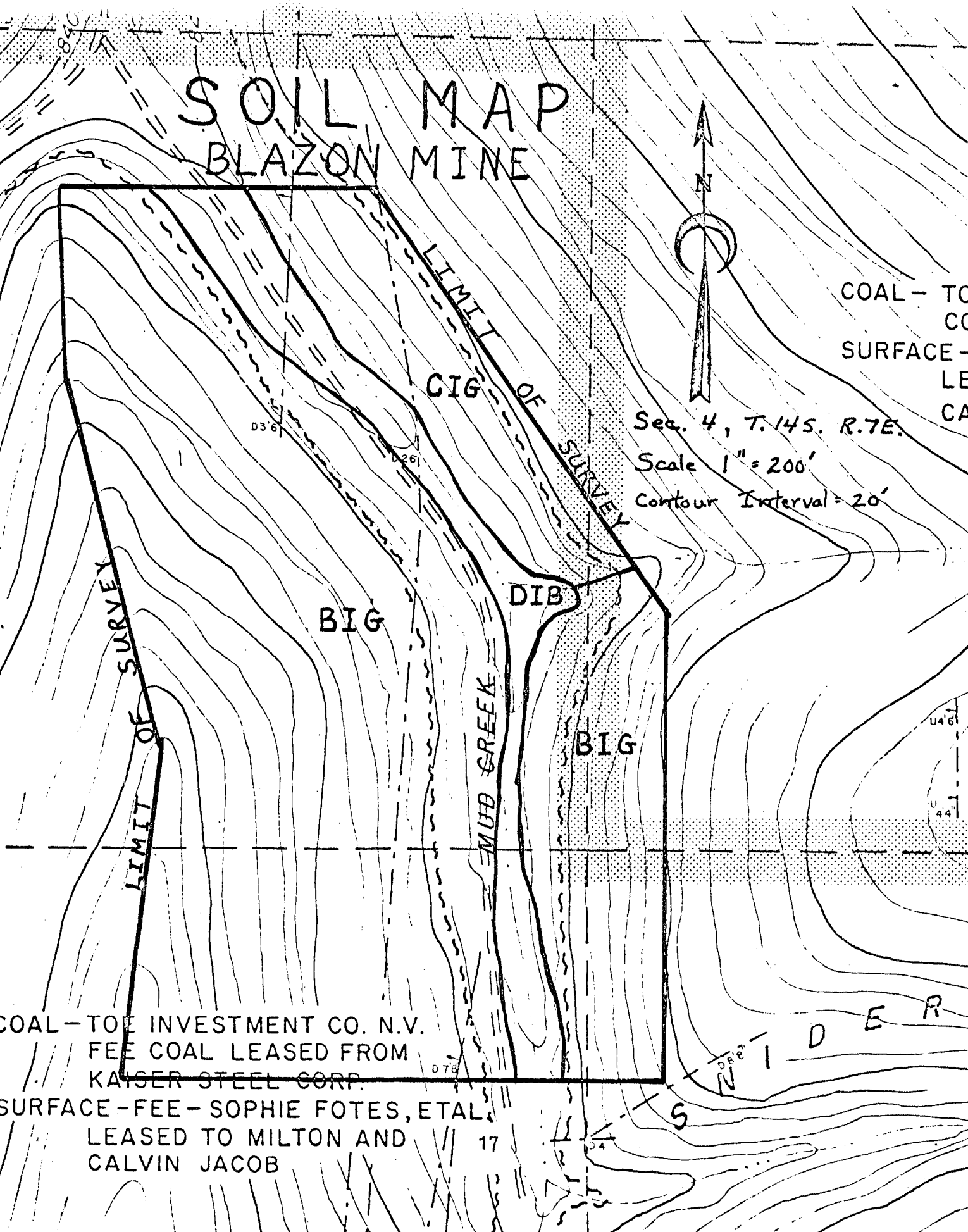
Understory cover of vegetation by ocular estimate is 50 to 60 percent.

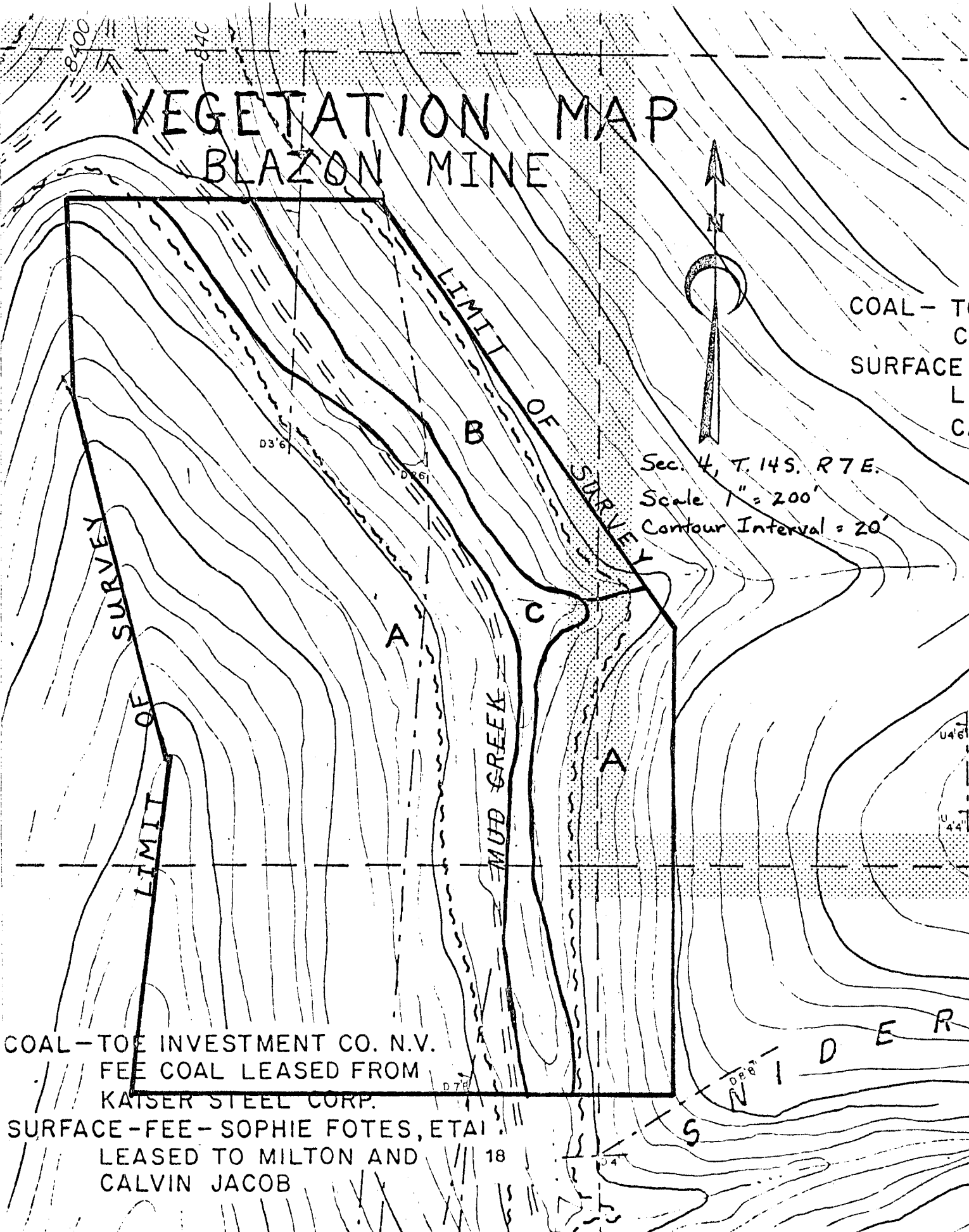
Plant species not a part of the climax plant community that are most likely to invade the site if plant cover deteriorates are cheatgrass, cocklebur, curlycup gumweed, lambsquarters, houndstongue, mullein, poverty weed, Canadian thistle, bull thistle, burdock, and rubber rabbitbrush. With excessive grazing use, bigsagebrush, western wheatgrass, and tree species will increase. Big sagebrush may become the dominant plant.

Potential yields for an excellent condition semiwet streambottoms range site are shown in the following table. This yield data is based on 20 plots in good condition and 20 plots in fair condition.

TOTAL POTENTIAL ANNUAL PRODUCTION OF VEGETATION
For Excellent Condition Class
Semiwet Streambottoms Range Site

	Total All Vegetation	
	Kg/Ha	Lbs/Ac
Favorable Years	2800	2500
Median Years	2240	2000
Unfavorable Years	1680	1500


SOIL MAP
BLAZON MINE
N
LIMIT OF SURVEY
CIG
DIB
BIG
MUD CREEK
BIG
LIMIT OF SURVEY
Sec. 4, T. 14S. R. 7E.
Scale 1" = 200'
Contour Interval = 20'
COAL – TOE INVESTMENT CO. N.V.
FEE COAL LEASED FROM
KAISER STEEL CORP.
SURFACE-FEE – SOPHIE FOTES, ETAL.
LEASED TO MILTON AND
CALVIN JACOB
17


VEGETATION MAP
BLAZON MINE
N
LIMIT OF SURVEY
SURVEY
LIMIT OF
MUD CREEK
A
B
C
A
Sec. 4, T. 14S. R 7 E.
Scale 1" = 200'
Contour Interval = 20'
COAL-TOE INVESTMENT CO. N.V.
FEE COAL LEASED FROM
KAISER STEEL CORP.
SURFACE-FEE-SOPHIE FOTES, ETAL
LEASED TO MILTON AND
CALVIN JACOB
18

Glossary

Alluvium—Soil materials, such as sand, silt, or clay and rock fragments that have been deposited on land by streams or moved and redeposited due to the surface movement of water.

Boulders—Rock fragments greater than 3 feet in diameter.

Cobbles—Rock fragments between 3 inches and 10 inches in diameter.

Colluvium—Soil materials and rock fragments moved and redeposited primarily under the influence of gravity.

Depth, soil—In this report the following terms and their meanings are used to describe the depth of the soil over bedrock:

very deep	More than 60"
deep	40-60"
moderately deep	20-40"
shallow	10-20"

Gravel—Rock fragments from 2 millimeters to 3 inches in diameter.

Leaching—The removal of soluble material from soils or other material by percolating water.

Pedon—A three dimensional unit with its lateral dimension being the smallest size necessary to represent the variability in soil properties of the soil being described.

pH value—a numerical means of designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value—alkalinity; and lower value—acidity.

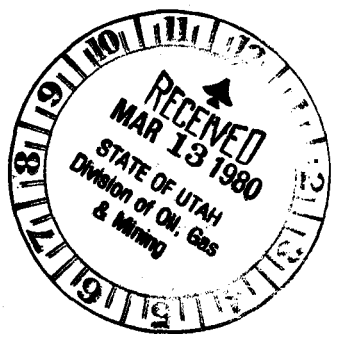
Residuum—Soil materials weathered from the parent material in place.

Stones—Rock fragments between 10 inches and 3 feet in diameter.

ACT/007/021

Soils & Vegetation

Blazon No. 1 Mine



SOIL SURVEY AND INTERPRETATIONS
PRELIMINARY VEGETATION SURVEY
for
Blazon Mining Company
March 11, 1980
Gary Moreau, District Conservationist
Earl Jensen, Soil Scientist
George Cook, Range Conservationist

The proposed Blazon Mine area is located one mile south of Clear Creek, Utah, in Carbon County. At the request of Joe Harvey representing Blazon Mining Company and the Price River Watershed Soil Conservation District, the Soil Conservation Service performed a soil survey on the proposed mining site. The survey was designed to comply with the Permanent Regulatory Program, Office of Surface Mining Reclamation and Enforcement, Department of Interior.

The soils included in the inventory cover approximately 25 acres of land near Mud Creek and Little Snider Canyons, Section 4, T. 14 S., R. 11 E., SLBM. The soils are shown on the attached map. Each soil is identified with a three letter symbol, and the pattern and extent denoted by the soil boundary lines on the map. All areas having the same symbol are essentially the same kind of soils. There may be small areas of included soils that are slightly different. The soils have not been named or correlated. When the overall county survey is completed, small areas may become inclusions in other map units. Immediately following the soil descriptions is a table pointing out limitations of the soils for a variety of uses.

The vegetation was analyzed using the range site methods of the Soil Conservation Service. Range sites are shown on the attached map. Only preliminary information was obtained before a light snow arrived in the survey area. Another field trip will be required to identify the low growing grasses and forbs, and therefore, to assess present vegetation, productivity, and range condition. Presented in this report are the range site delineations with potential productivity according to favorable and unfavorable precipitation years.

More detailed information is on file in the Price Field Office of the Soil Conservation Service.

SOIL LEGEND

Soil Symbol	Soil Mapping Unit Name
BIG	BI stony loam, 50 to 70 percent slopes
CIG	CI loam, 40 to 65 percent slopes
DIB	DI loam, 2 to 5 percent slopes

DESCRIPTIONS OF THE SOILS

BIG BI stony loam, 50 to 70 percent slopes

This BI soil is moderately deep and well drained. It occurs on very stony mountain sideslopes along Mud Creek at elevations of 2590 to 2680 meters (8500 to 8800 feet). This soil formed in colluvium and residium derived mainly from sandstone and shale.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. Slopes are 50 to 70 percent and east, west, and north facing. They are medium and long in length and concave-convex in shape.

Vegetation is dominantly aspen, Douglas fir, white fir, peavine, blue wildrye.

Included in mapping are small areas of rock outcrop near the foot of the slopes.

In a representative profile the surface layer is dark grayish brown stony loam about 8 centimeters (3 inches) thick. The subsurface layer is light yellowish brown stony sandy loam about 20 centimeters (8 inches) thick. The subsoil is pale brown and light brownish gray, very stony clay loam about 74 centimeters (29 inches) thick over sandstone at a depth of 102 centimeters (40 inches).

Permeability is moderately slow. Available water capacity is about 13 centimeters (5 inches). Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is about 102 centimeters (40 inches). Surface runoff is slow and erosion hazard is slight under potential native vegetation and very high if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range, wildlife habitat, and woodland.

Taxonomic classification is fine-loamy, mixed typic cryoboralfs.

A representative pedon of BI stony loam, 50 to 70 percent slopes was described near the proposed portal of Blazon Company Mine.

O1—2.5 to 0 centimeter (1 to 0 inch); leaves and fir needles.

A1—0 to 8 centimeters (0 to 3 inches); dark grayish brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) when moist; moderate coarse granular structure; soft, friable, slightly sticky, slightly plastic; many very fine to large roots; 5 percent stones, 5 percent cobbles, 10 percent gravel; neutral reaction (pH 6.8); abrupt wavy boundary.

A2—8 to 30 centimeters (3 to 11 inches); light yellowish brown (10YR 6/4) stony sandy loam, yellowish brown (10YR 5/4) when moist; moderate coarse platy structure; slightly hard, friable, nonsticky, nonplastic; common very fine to medium roots; 5 percent stones, 5 percent cobbles, 10 percent gravel; neutral reaction (pH 6.6); clear smooth boundary.

B21t—30 to 61 centimeters (11 to 24 inches); pale brown (10YR 6/3) stony clay loam, brown (10YR 4/3) when moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; common very fine to large roots; common moderately thick clay films; 5 percent gravel, 5 percent cobbles, 10 percent stones; neutral reaction (pH 6.6); abrupt irregular boundary.

B22t—61 to 102 centimeters (24 to 40 inches); light brownish gray (10YR 6/2) very stony clay loam, dark grayish brown (10YR 4/2) when moist; moderate medium subangular blocky structure; hard, firm, sticky, plastic; common very fine to large roots; 10 percent gravel, 20 percent cobbles, 10 percent stones; mildly alkaline (pH 7.8); abrupt irregular boundary.

R—102 centimeters (40 inches); sandstone.

CIG CI loam, 40 to 65 percent slopes

This CI soil is moderately deep and well drained. It occurs on very steep mountain sideslopes on the east side of Mud Creek at elevations of 2560 to 2620 meters (8400 to 8600 feet). This soil formed in local colluvium and residium derived mainly from shale and sandstone.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature is 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. Slopes are 40 to 65 percent and west facing. They are medium and long in length and convex-concave in shape.

Vegetation is dominantly aspen, snowberry, blue wildrye, and native bluegrass.

Included in mapping are small areas of rock outcrop near the foot of the slopes.

In a typical profile the surface layer is dark brown loam about 10 centimeters (4 inches) thick. The underlying layer is brown, gravelly loam about 20 centimeters (8 inches) thick. The next layer is very pale brown, stony loam and stony clay loam about 66 centimeters (26 inches) thick. Depth to soft shale is 97 centimeters (38 inches).

Permeability is moderately slow. Available water capacity is 11 to 13 centimeters (4.5 to 5 inches) to a 97 centimeter (38 inch) depth. Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is about 97 centimeter (38 inches). Surface runoff is medium and erosion hazard is moderate under potential native vegetation and very high if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range and wildlife habitat.

Taxonomic classification is fine-loamy, mixed typic cryoborolls.

A typical pedon of CI loam 40 to 65 percent slopes was described in the excavation east of the junction of Long Canyon and Mud Creek.

A11—0 to 10 centimeters (0 to 4 inches); dark brown (10YR 4/3) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine, common medium and coarse roots; 10 percent gravel; neutral reaction (pH 6.8); abrupt wavy boundary.

A12—10 to 30 centimeters (4 to 12 inches); brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and coarse roots; 15 percent gravel, 5 percent cobbles; neutral reaction (pH 6.6); clear wavy boundary.

C1—30 to 81 centimeters (12 to 32 inches); very pale brown (10YR 7/3) stony loam, brown (10YR 4/3) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, and coarse roots; 15 percent gravel, 10 percent cobbles, 10 percent stones; slightly acid (pH 6.4); clear wavy boundary.

C2—81 to 97 centimeters (32 to 38 inches); very pale brown (10YR 7/3) stony clay loam, grayish brown (10YR 5/2) when moist; rock structure; very hard, very firm, very sticky, very plastic; few very fine and fine roots; 15 percent gravel, 10 percent cobbles, 10 percent stones; slightly acid (pH 6.4); abrupt smooth boundary.

C35—97 centimeters (38 inches); soft shale.

DIB DI loam, 2 to 5 percent slopes

This DI soil is very deep and moderately well drained. It occurs on flood plains and alluvial fans at elevations of about 2590 meters (8500 feet). This soil formed in alluvium derived mainly from sandstone, quartzite and shale.

The average annual precipitation is 56 to 64 centimeters (22 to 25 inches). Mean annual air temperature is 2 to 3°C (36 to 37°F), mean annual soil temperature is 3 to 4°C (37 to 39°F), and the average freeze-free season is 57 days. This soil occurs adjacent to Mud Creek.

Slopes are 2 to 5 percent and north facing. They are short in length and concave-convex in shape.

Vegetation is dominantly sedge, slender wheatgrass, and native bluegrass.

Included in mapping are small areas of poorly drained soils with wet meadow vegetation. These areas are located near the stream and may be flooded at times.

In a typical profile the surface layer is dark grayish brown loam about 71 centimeters (28 inches). The underlying layer is brown, very fine sandy loam 43 centimeters (17 inches) thick. The next layer is grayish brown, cobbly very fine sandy loam to a depth of more than 152 centimeters (60 inches). The water table is at a depth of about 114 centimeters (45 inches) for a short time in the spring.

Permeability is moderate. Available water capacity is 20 to 23 centimeters (8 to 9 inches) to a depth of 152 centimeters (60 inches). Organic matter content in the surface layer is 5 to 10 percent. Effective rooting depth is more than 152 centimeters (60 inches). Surface runoff is slow and erosion hazard is slight under potential native vegetation and moderate if vegetation is removed and the soil is left bare. Erodibility is moderate.

This soil is used for range and wildlife habitat.

Taxonomic classification is fine-loamy, mixed cumulic cryoborolls.

A typical pedon of DI loam, 2 to 5 percent slopes was described near the stream bank of Mud Creek about 15 meters (50 feet) south of the junction of Little Snider Canyon and Mud Creek.

A1—0 to 8 centimeters (0 to 3 inches); dark grayish brown (10YR 2/2) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; soft, very friable, slightly sticky, slightly plastic; common fine and very fine roots; neutral reaction (pH 6.6); clear smooth boundary.

A12—8 to 61 centimeters (3 to 24 inches); dark grayish brown (10 YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine and very fine roots; neutral reaction (pH 6.8); abrupt smooth boundary.

A13—61 to 71 centimeters (24 to 28 inches); dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; neutral reaction (pH 7.0); clear smooth boundary.

C1—71 to 114 centimeters (28 to 45 inches); brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, slightly sticky, nonplastic; 10 percent gravel; neutral reaction (pH 7.0); clear wavy boundary.

C2—114 to 152 centimeters (45 to 60 inches); grayish brown (10YR 5/2) cobbly very fine sandy loam, very dark brown (10YR 2/2) when moist; massive; soft, very friable, slightly sticky, nonplastic; 15 percent gravel, 20 percent cobbles; neutral reaction (pH 7.0).

SOIL INTERPRETATIONS AND LIMITATIONS**

Blazon Mine Survey Area

Use	Soil		
	CIG	BIG	DIB
Shallow Excavation	Severe—Slope	Severe—Depth to rock, slope	Slight
Local Roads and Streets	Severe—Slope	Severe—Low strength, slope	Moderate—Low strength, floods
Roadfill	Poor—Slope	Poor—Low strength, slope	Fair—Low strength, wetness
Topsoil	Poor—Large stones, slope	Poor—Large stones, slope	Good
Pond Reservoir Area	Severe—Slope	Severe—Slope	Moderate—Seepage, slope
Embankments, Dikes, Levees	Moderate—Thin layer, large stones	Moderate—Thin layer, piping, large stones	Severe—Piping
Seeding	Poor—Slope, large stones	Poor—Slope, large stones	Good

** Ratings are based on criteria in the National Soils Handbook, SCS, USDA

DESCRIPTION OF VEGETATION

The Blazon Mine site was visited late in the fall after the first snow had fallen. Present vegetation and productivity was not attained but will be recorded in early summer. Enough information was received to evaluate the sites for potential productivity according to range site analysis methods of the Soil Conservation Service. The following sites are keyed to the attached vegetation map.

Site A—Woodland Ecosystem—High Mountain Loam (Aspen)

This woodland community occurs on steep mountain slopes of 50 to 70 percent. Elevation ranges from 2590 to 2680 meters (8500 to 8800 feet). It occurs on all exposures but is primarily on the north and east in the survey area.

Climate is cool and humid with average annual precipitation ranging from 56 to 64 centimeters (22 to 25 inches).

Quaking aspen is the dominant overstory plant. Canopy density will vary from 25 to 70 percent, but is most common from 40 to 55 percent. Shade tolerant plants such as blue wildrye, bearded wheatgrass, mountain brome, nodding bluegrass, sweetanice, meadowrue and edible valerian are the dominant understory species.

Vegetation is an overstory of quaking aspen. The understory consists of approximately 60 percent grasses, 30 percent forbs and 10 percent shrubs and tree reproduction. Total vegetation is 40 percent aspen, 35 percent grasses, 20 percent forbs and 5 percent shrubs.

This woodland site relates to the BIG soil.

The following table lists the potential plant community for the high mountain loam (aspen) woodland site. These species have been identified on similar sites. Those occurring on the Blazon Mine site will not be known until after the 1980 summer field trip. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Nature of Potential Plant Community—High Mountain Loam (Aspen)

Species	Canopy Class: Sparse 25-50% %/wt	Med 51-65% %/wt	Dense 65% %/wt
GRASSES AND GRASS-LIKE			
Bearded wheatgrass	5	3	T
Blue wildrye	13	5	T
Columbia needlegrass	1	1	T
Dryland sedge	5	10	10
Kentucky bluegrass	1	5	10
Mountain brome	30	20	5
Nodding bluegrass	6	3	T
Nodding brome	1	1	T
Oniongrass	1	1	T
Slender wheatgrass	3	2	1
FORBS			
Aster	1	1	1
Bluebell	1	5	10
Butterweed	5	3	T
Cow cabbage	1	1	T
Descurainia	1	5	10
Edible valerian	5	1	-
Geranium	1	1	1
Horsemint	1	5	1
Jacob's ladder	2	1	-
Lupine	1	2	3
Meadowrue	1	5	5
Peavine	5	5	10
Poison vetch	1	5	5
Senecio	1	5	5
Stellaria	1	1	-
Sweetanice	6	3	-
Tall larkspur	1	5	10
Violet	1	2	5
Wild carrot	1	1	-
Western coneflower	1	5	15
Yarrow	1	5	5
SHRUBS AND TREES			
Chokecherry	1	2	5
Elderberry	1	1	-
Mountain ash	1	1	1
Oregon grape	1	1	5
Quaking aspen	*5 40	*5 50	*10 70
Rose	1	T	-
Serviceberry	1	1	-
Snowberry	1	5	10
Willow	1	1	5

* Production to 1.37 meters (4.5 feet) height

The following table shows the total annual production on air dry weight basis for a sparse canopy class of high mountain loam (aspen). This data is based on 162 plots taken in excellent condition, 373 plots in good condition, 410 plots in fair condition, and 83 plots in poor condition.

TOTAL ANNUAL PRODUCTION OF VEGETATION
For Sparse Canopy Class

	Total All Vegetation Kg/Ha	Total All Vegetation Lbs/Ac	Total Below 1.37m(4.5 Ft) Kg/Ha	Total Below 1.37m(4.5 Ft) Lbs/Ac
Favorable years	5,625	5,000	3,650	3,250
Average years	3,925	3,500	2,550	2,275
Unfavorable years	2,250	2,000	1,450	1,300

Site B—High Mountain Loam

This range site occurs on very steep mountain slopes. It is found on west exposures in the study area. The slopes are mostly 40 to 65 percent. The elevation ranges from 2560 to 2620 meters (8400 to 8600 feet).

The climate of the site is cool and humid with cold, snowy winters. The average annual precipitation varies from 56 to 64 centimeters (22 to 25 inches). Distribution of this moisture is generally 23 to 35 percent during the plant growing season. Thus, most of the effective moisture comes from snowmelt from winter precipitation.

Plant growth begins about May 10-20 and ends due to killing frosts about September 15 to October 1. Moisture and temperature are such that they are not limiting to plant growth during this period except some years a small moisture deficiency in July and August will slow down growth of herbage and may force grass and forb species into early maturity. The frost-free period is 50 to 90 days. Mean annual air temperature is 2 to 3°C (36 to 37°F).

This range site relates to the CIG soil.

The potential vegetative composition by weight is approximately 55 percent grasses, 25 percent forbs and 20 percent shrubs with a large total number of forb species. The following table shows major plant species and percentages of the total potential plant community by weight that each normally contributes. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Potential Plant Community—High Mountain Loam

Grass and Grass-Like Plants	Percent
Basin wildrye	5
Bearded wheatgrass	10
Blue wildrye	5
Columbia needlegrass	4
Idaho fescue	5
*Kentucky bluegrass	3
King's fescue	1
Letterman needlegrass	10
Mountain brome	16
Muttongrass	10
Nodding bluegrass	10
Nodding brome	1
Oniongrass	1
Prairie junegrass	1
Sedge	2
Sheep fescue	1
Slender wheatgrass	30
Tall bluegrasses	5

*Not a part of original climax vegetation, but has now established an ecological niche in the potential plant community.

Forbs	
Arrowleaf balsamroot	1
Aster	4
Astragalus	1
Bluebell	2
Butterweed	10
Columbine	1
Deathcamas	1
Edible valerian	1
Elk thistle	1
Eriogonum	1
Falsehellebore	1
Geranium	2
Horsemint	4
Indianpaintbrush	1
Jacob's ladder	5
Knotweed	1
Lewis flax	1
Little sunflower	3
Lomatium	4
Low larkspur	1

Forbs (Cont)	Percent
Lupine	2
Mulesear dock	3
Native clover	2
Others	5
Peavine	6
Penstemon	2
Phacelia	1
Senecio	1
Showy elkweed	1
Skeleton loco	1
Sneezeweed	2
Stoneseed	3
Sweetanice	2
Tapertip hawksbeard	1
Tall larkspur	2
Timber poisonvetch	1
Wild carrot	1
Yarrow	3
Shrubs and Trees	
Antelope bitterbrush	2
Big sagebrush	3
Bittercherry	2
Chokecherry	5
Currant	2
Elderberry	7
Mountain snowberry	7
Oregon grape	2
Serviceberry	3
Silver sagebrush	2
Snowbrush ceanothus	5
Threetip sagebrush	2
Wood's rose	1
Yellowbrush	3

No trees occur on this range site.

Vegetative cover by ocular estimate is 70 to 75 percent.

Plant species not a part of the climax plant community that are most likely to invade the site if plant cover deteriorates are annual grasses and annual forbs. When retrogression occurs, shrubs greatly increase, primarily sagebrush species.

Potential yields from an excellent condition high mountain loam range site are shown in the following table. This yield data is based on 110 plots in excellent condition, 49 plots in good, 154 plots in fair, and 30 plots in poor condition.

TOTAL POTENTIAL ANNUAL PRODUCTION OF VEGETATION
For Excellent Condition Class
High Mountain Loam Range Site

	Total All Vegetation	
	Kg/Ha	Lbs/Ac
Favorable Years	3360	3000
Median Years	2800	2500
Unfavorable Years	1324	1450

Site C—Semiwet Streambottoms

This site occurs on gently sloping and moderately sloping flood plains in canyon and small valley bottoms and along low benches adjacent to stream bottoms. There are many strongly sloping alluvial fans at the mouth of the tributaries. Slopes are generally 2 to 5 percent. Elevations are about 2590 meters (8500 feet).

The climate of this site is cool and quite humid with cold and snowy winters. The average annual precipitatiion varies 56 to 64 centimeters (22 to 25 inches). Distribution of annual precipitation is about 20 percent during the plant growing period (May to September), and about 80 percent during the non-growing period, as shown by the Snake Creek weather station records. In the spring and early summer months, a moderately deep water table drops during the late summer months and at this time the more shallow rooted plants are not affected by sub-irrigation.

Plants begin to grow about May 1 to June 1. During the hot and dry part of the summer, the grasses and forbs will become dormant. Some regrowth occurs after September 1, when sufficient moisture is available. Shrub species grow throughout the summer and until fall frosts. The optimum growth period of all plants is during May and June. The frost-free period is from 80 to 95 days which is near June 1 to September 15.

This range site relates to the DIB soil.

The vegetation of this site usually has a variable overstory of water-loving trees and shrubs of approximately 40 percent of the total production annually on an air dry basis. Grasses are about 45 percent of the plant composition and forbs 15 percent. The following table shows major plant species and percentages of the total potential plant community by weight that each normally contributes. Those species occurring at higher percentages of air dry weight constitute more important species at the site.

Potential Plant Community--Semiwet Streambottoms

Grasses and Grass-Like Plants	Percent
Basin wildrye	5
Bearded wheatgrass	10
Bluebunch wheatgrass	10
Blue wildrye	15
Bottlebrush squirreltail	1
Columbia needlegrass	2
Kentucky bluegrass	10
Letterman needlegrass	5
Mountain brome	10
Muttongrass	10
Needle and thread	5
Nevada bluegrass	5
Oniongrass	2
Rushes	1
Sedge	5
Slender wheatgrass	10
Redtop	5
Western wheatgrass	10
Wiregrass	1
Forbs	
Aster	1
Buckwheat	2
Butterweed	3
Cinquefoil	1
Common cowparsnip	5
Clover	3
Edible valerian	5
Geranium	5
Goldenpea thermopsis	3
Goldenrod	1
Herbaceous sagewort	2
Horsemint	5
Lambstongue groundsel	1
Showy goldeneye	5
Lupine	2
Peavine	5
Starry falsesolomonseal	1
Sweetanise	5
Yarrow	2

Shrubs and Trees	Percent
Big sagebrush	5
Bigtooth maple	1
Blue elderberry	2
Boxelder	5
Chokecherry	5
Currant	1
Dogwood cottonwood	15
Gambel oak	5
Mountain snowberry	5
Oregon grape	1
Quaking aspen	3
Rabbitbrush	1
Redosier dogwood	1
Rockymountain juniper	3
Serviceberry	3
Snowberry	3
Thinleaf alder	5
Virgins bower	2
Water birch	5
Willow	15
Wood's rose	1
Yellowbrush	2

Several water-loving tree species are found in scattered clumps or as single trees throughout this site. Boxelder, Fremont cottonwood, narrowleaf cottonwood, quaking aspen, thinleaf alder, Rockymountain juniper and water birch are present along with tall shrub species such as bigtooth maple, chokecherry, and several species of willow.

These overstory species have an overstory cover of 10 to 40 percent depending on distance from the water table or stream course.

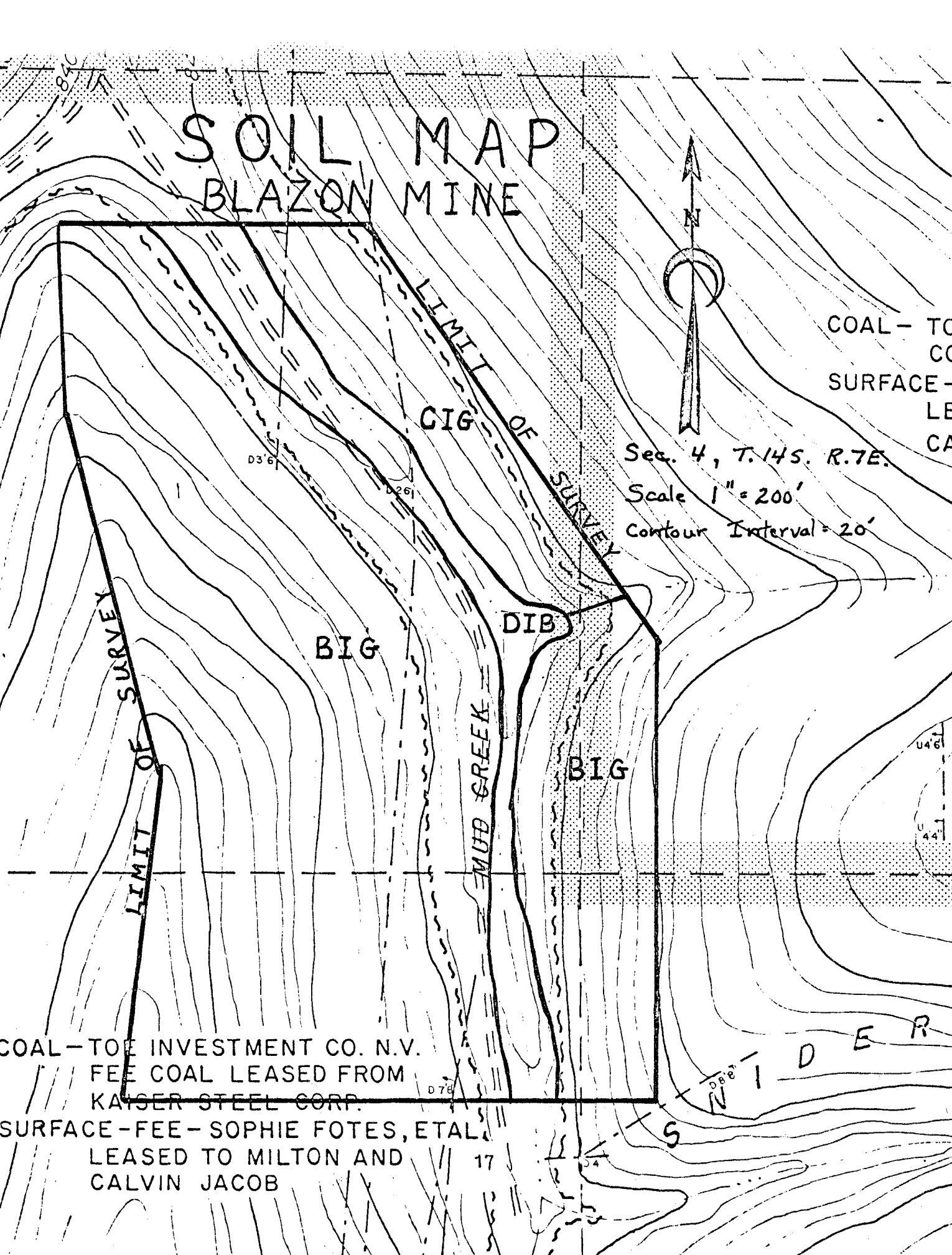
Understory cover of vegetation by ocular estimate is 50 to 60 percent.

Plant species not a part of the climax plant community that are most likely to invade the site if plant cover deteriorates are cheatgrass, cocklebur, curlycup gumweed, lambsquarters, houndstongue, mullein, poverty weed, Canadian thistle, bull thistle, burdock, and rubber rabbitbrush. With excessive grazing use, bigsagebrush, western wheatgrass, and tree species will increase. Big sagebrush may become the dominant plant.

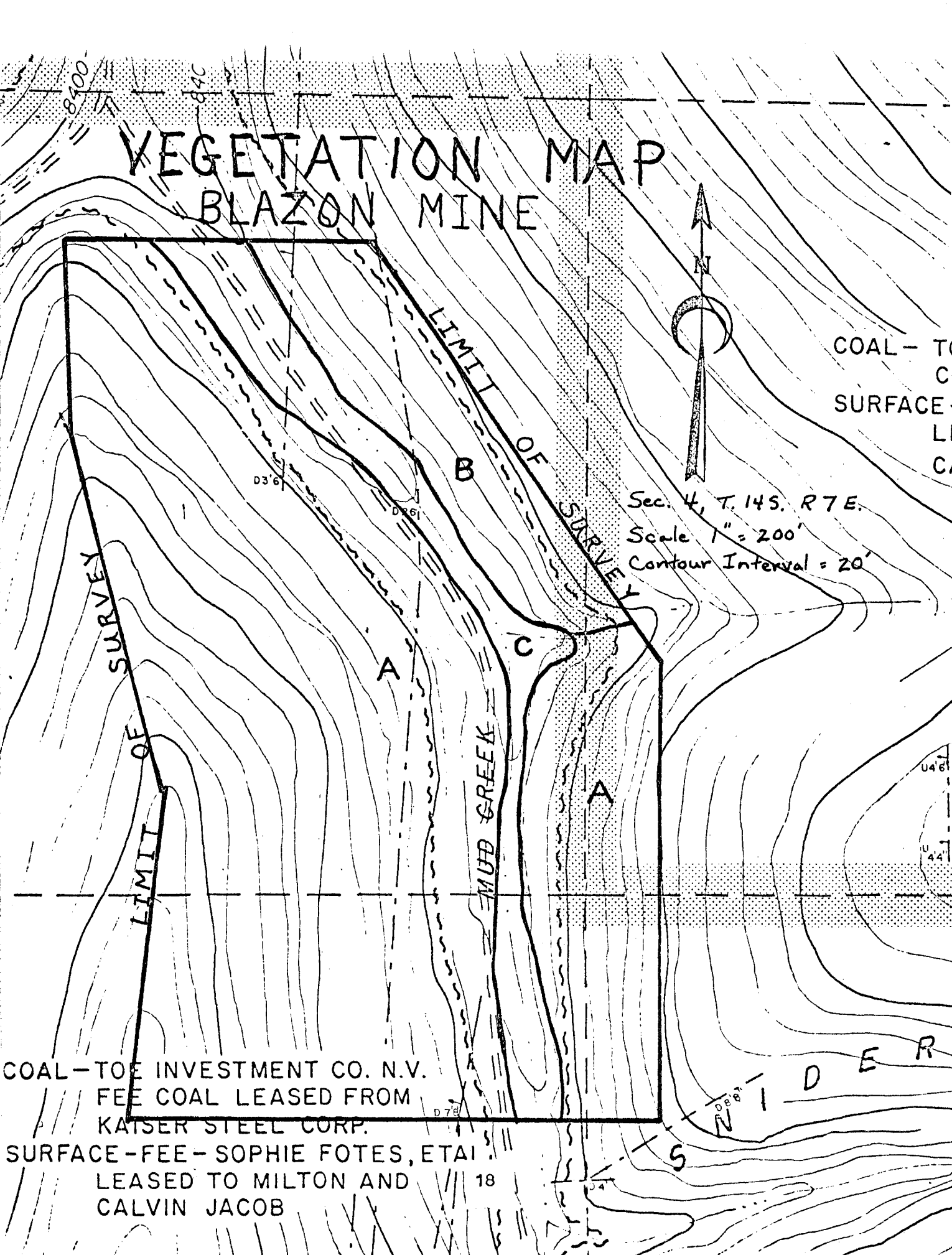
Potential yields for an excellent condition semiwet streambottoms range site are shown in the following table. This yield data is based on 20 plots in good condition and 20 plots in fair condition.

TOTAL POTENTIAL ANNUAL PRODUCTION OF VEGETATION
For Excellent Condition Class
Semiwet Streambottoms Range Site

	Total All Vegetation	
	Kg/Ha	Lbs/Ac
Favorable Years	2800	2500
Median Years	2240	2000
Unfavorable Years	1680	1500


SOIL MAP
BLAZON MINE
N
Sec. 4, T. 14S. R. 7E.
Scale 1" = 200'
Contour Interval = 20'
LIMIT OF SURVEY
CIG
DIB
BIG
MUD CREEK
BIG
LIMIT OF SURVEY
COAL – TOE INVESTMENT CO. N.V.
FEE COAL LEASED FROM
KAISER STEEL CORP.
SURFACE – FEE – SOPHIE FOTES, ETAL.
LEASED TO MILTON AND
CALVIN JACOB
17
S
I D E R

VEGETATION MAP
BLAZON MINE



Glossary

Alluvium—Soil materials, such as sand, silt, or clay and rock fragments that have been deposited on land by streams or moved and redeposited due to the surface movement of water.

Boulders—Rock fragments greater than 3 feet in diameter.

Cobbles—Rock fragments between 3 inches and 10 inches in diameter.

Colluvium—Soil materials and rock fragments moved and redeposited primarily under the influence of gravity.

Depth, soil—In this report the following terms and their meanings are used to describe the depth of the soil over bedrock:

very deep	More than 60"
deep	40-60"
moderately deep	20-40"
shallow	10-20"

Gravel—Rock fragments from 2 millimeters to 3 inches in diameter.

Leaching—The removal of soluble material from soils or other material by percolating water.

Pedon—A three dimensional unit with its lateral dimension being the smallest size necessary to represent the variability in soil properties of the soil being described.

pH value—a numerical means of designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value—alkalinity; and lower value—acidity.

Residuum—Soil materials weathered from the parent material in place.

Stones—Rock fragments between 10 inches and 3 feet in diameter.

To Lee
for action
File
ACT/007/021

Jim

Blazon Co.

(MINING CONTRACTORS & CONSULTANTS)

MAY 8 1991
LCS

Re: Blazon Mine No. 1
ID No. 42-01582
ACT/007/021

RECEIVED
MAY 7 1991
DIVISION OF
OIL, GAS & MINING

MAY 8 1991
LCS

James Smith Jr., Coordinator
Dept. Of Natural Resources
Division of Oil Gas & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Dear Mr. Smith

In accordance with UMC 784.19 the plan for underground development waste is being submitted for your review and approval.

We propose an extension of our present portal pad for disposal of some two thousand cubic yards of material.

As you will note from the data contained in the study made by R & M Consultants Inc., the stability factor is 1.43 to 1.5 .

The selected area will receive the normal rainfall water production, all other water is being diverted by means of a two foot culvert installed to by-pass the Little Snyder drainage which was previously approved by the Division.

Since the area available for rock waste disposal is severely limited we propose placing a perforated three inch steel pipe vertically in the fill in order to monitor any water accumulation that may occur within the confines of the storage zone.

Your approval of the above experimental practice in lieu of extensive rock drains would be appreciated.

The final reclamation of the area would include a top soil layer of sufficient depth to support native growth of small shrubs and grasses.

We urgently request a decision from you because a roof failure occured 106' feet in by the portals. The roof failure requires that we dispose of the fall material promptly.

Sincerely,

Joseph A. Harvey

Joseph A. Harvey
Pres. Blazon Company

Clear Creek Star Route • Helper, Utah 84526 • Telephone (801) 448-9408

BLAZON MINE

FILL SLOPE STABILITY STUDY

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS

R&M CONSULTANTS, INC. BUSCH PARK • 5280 SOUTH 320 WEST, SUITE E-160 • MURRAY, UTAH 84107 • PHONE (801) 263-3419
ENGINEERS
GEOLOGISTS

April 23, 1981

R&M No. 161009

Joe Harvey
Blazon Mine
Clear Creek, UT 84538

Dear Joe,

Attached please find two copies of the report concerning stability of waste material to be placed on the mine property at Blazon Mine. Preparation of this report was authorized per your verbal request on April 16, 1981.

The lowest factor of safety for the fill placement was slightly less than 1.5 for the most critical case, however parameters used in the calculations for the angle of internal friction and cohesion values were purposely selected on the conservative side. Therefore, the 1.43 factor of safety is also conservative and should be acceptable. Recommendations for fill placement are also included within the report and should be followed in order to ensure safety against sliding.

We appreciate the opportunity of having participated on this project and will be happy to answer any questions you may have concerning this report.

Sincerely,

Larry Migliaccio, P.E.
Director

cw

cc: Lee Rowley/Boyle Engr
Lee Spencer/Div of Oil&Gas Mining

BLAZON MINE

FILL SLOPE STABILITY STUDY

I. INTRODUCTION

The owner of the Blazon Coal Mine which is located to the immediate south of Clear Creek, Utah, off Highway 96 at the mouth of Snider Canyon, is proposing to dispose of mine spoil material from the mine shafts onto the valley area north of the adjacent mine portal bench (Drawing No. 1).

The objectives of this study are: 1) to perform slope stability analyses on the proposed fill, 2) to present our recommendations regarding the construction of this fill to meet the safety requirements of the federal regulations.

II. SUBSURFACE CONDITIONS

In September 1980, a layer of fill material about 6-ft thick was placed over natural soils on the slopes just below the mine portal bench. A report entitled "Blazon Mine Fill Slope Stability Investigation" was prepared by R&M Consultants, Inc. in October 1980 for the study of the stability of that fill operation. Prior to that, the surface conditions at the mine site were compiled in a report "Subsurface Soil Investigation, Blazon Mine and Colton Load-Out Facility", also prepared by R&M Consultants, Inc. in August, 1980.

A detailed description of the subsurface conditions, including the nature of the previously placed fill material, can be found in the two reports referenced above. Briefly, the natural soil at the mine site is of colluvial origin derived from the weathering of the underlying bedrock. The depth of the overburden soil varies from about 1 ft on the steeper hillsides to over 5 ft toward the Clear Creek

channel. The bedrock consists mainly of thickly-bedded sandstones and bituminous coal beds with thinly-bedded shales.

The previously placed fill below the portal bench was the cut material from the portal area consisting of highly decomposed shale with small amounts of silt, sandstone, and occasional large boulders. This fill material was not compacted with any effort other than its own weight. The fill was considered to have no cohesion at the beginning of its placement, but would gain a certain degree of cohesion after a period of time when the decomposed shale component developed its binding action due to consolidation and moisture infiltration into the fill material.

The proposed fill is to be placed on top of the previously placed fill and natural soil. The characteristics of the new fill material are very similar to that of the previously placed fill as they are from practically the same source. Unlike the existing fill, however, the proposed fill will be subjected to controlled compaction.

III. ANALYSIS

Both short term and long term conditions for the proposed fill were investigated in this study. For the short term condition, the compacted fill material was considered to be of little cohesion and its shear strength was mainly derived from the friction between the soil particles. Under long term condition, the remolded component of the decomposed shale was considered to have partially regained cohesion by absorbing moisture from precipitation runoff. The shear strength of the fill under long term effect was therefore considered to be contributed partly from the restored cohesion and partly from the friction between soil particles.

Based on the previously conducted subsurface investigation and discussions with the owner on the existing and new fill materials, the following estimated soil

parameters were used in the stability analysis for the proposed fill area:

Soil Stratum		Unit Weight γ, pcf	ϕ degrees	c psf
Proposed Compacted Fill	Short Term	120	35	0
	Long Term	120	20	300
Existing Fill & Overburden Soil		110	20	300

The bedrock was considered to have such a high shear strength that the failure slip surface could not cut into the rock.

The Swedish Slip Circle method was utilized to analyze the slope stability of the proposed fill. A typical cross section along the steepest grade of the existing valley in the proposed fill area was investigated. At this cross section, the top of the proposed fill meets the shoulder of the upper appraoch roadway bounded to the east of the fill area and slopes downhill in 10% grade for a horizontal distance of about 125 ft, then drops sharply over 20 ft in a 1:1 slope to meet a low retaining wall just above the lower-level approach roadway. A total of 4 trial failure circles were analyzed. These were circles of various radii cutting into different materials or combination of materials. For each trial circle, both short term and long term effects of the proposed new fill were considered.

The location of each trial failure circle superimposed on the cross section under study and the computation of its corresponding factor of safety are presented on Drawings 2A, 2B through 5A and 5B. Results indicate that the most critical failure circle is a slip circle cutting very close to the top and the toe of the 1:1 slope of the fill just behind the retaining wall. The computed factors of safety of this most critical case are 1.49 for the short term condition and 1.43 for the long term condition of the new fill, just slightly below the minimum of 1.5 required

by [1]CFR for long term condition. Factors of safety for all other trial slip circles against slope failure exceed this minimum requirement.

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the above analyses, we conclude that the contemplated fill in the proposed area would be stable if recommendations provided in this report are followed. The most probable slope failure would roughly conform to a slip circle passing very close to the top and toe of the 1:1 slope of the proposed fill just behind the retaining wall. Extent of failure and damage of this failure mode, should it occur, would be limited since only a localized quantity of material at the tip of the fill would slide.

To ensure a stable condition of the proposed fill, our recommendations regarding the construction requirements are made as follows:

1. The 1:1 slope of the fill just behind the retaining wall and above the lower level approach roadway be flattened to 1H:3/4V such that the factor of safety of the proposed fill against slope failure under any condition would be at least 1.5.

2. The vegetation and top soil on the existing ground of the proposed fill area be cleared and scarified before the proposed new fill is placed. The fill material should be free of organic substances, debris, frozen clods, and boulders more than 8 inches in size, and should be compacted in 12-inch loose horizontal lifts to at least 90% of the maximum density determined by ASTM D1557-78 (Modified Proctor Method). Boulders larger than 8 inches should be placed along the toe of the fill as rock toe buttress.

---

[1]"Code of Federal Regulations, Volume 30 - Mineral Resources" revised as of July 1, 1979, published by the Office of Federal Register, Chapter VII - Office of Surface Mining, etc.

3. The surface of the proposed fill should be re-vegetated to prevent surface erosion and pore pressure buildup in the fill material from excessive infiltration of surface runoff.

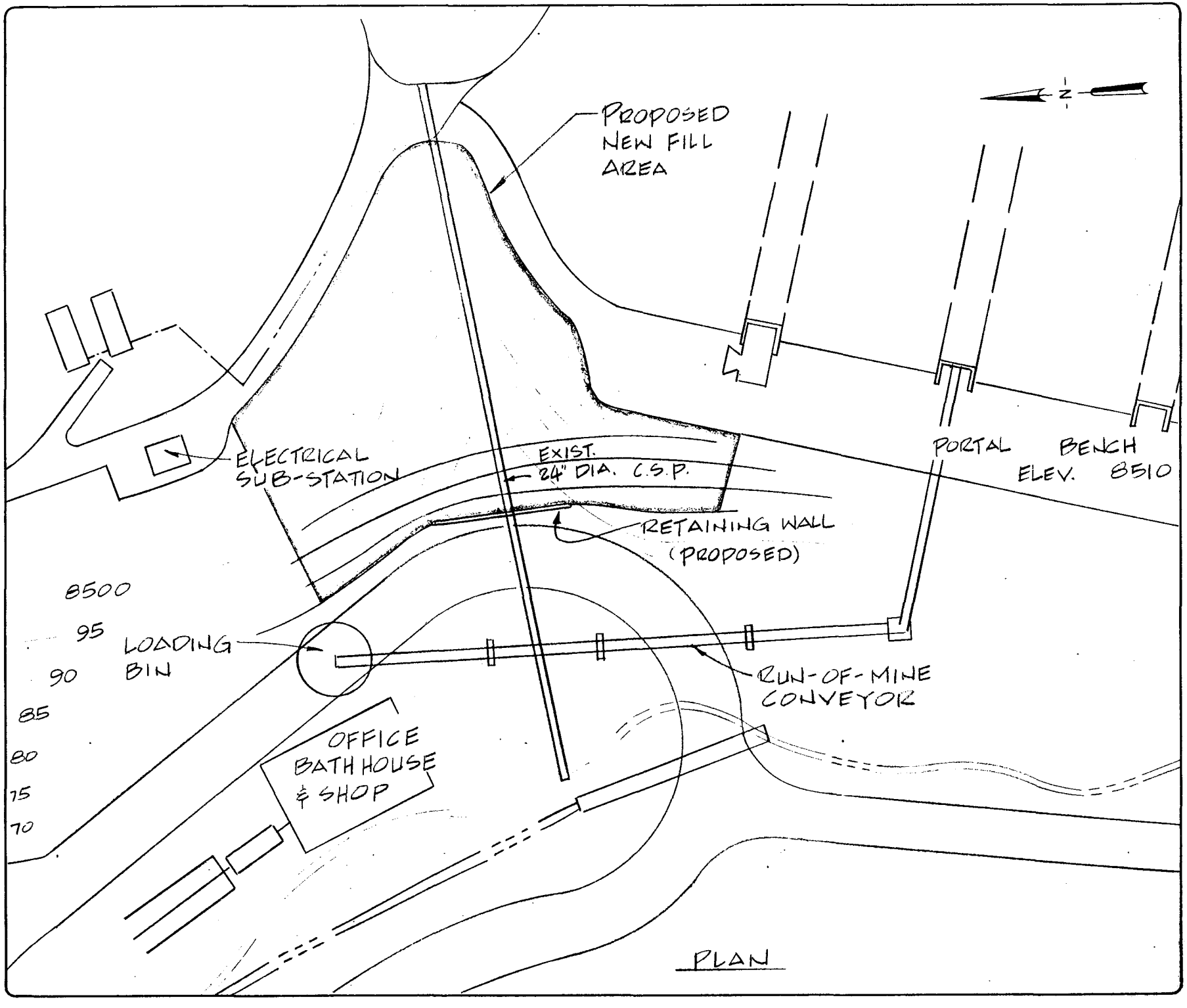
4. A drainage blanket constructed with clean rock should be provided behind the retaining wall with weep holes furnished in the retaining wall to prevent hydrostatic pressure buildup against the retaining wall. Rock buttress keyed into the existing ground should be provided along the toe of the fill if the retaining wall is to be eliminated. The rock used for constructing the toe buttress should be clean and well-graded from 3 inches to 30 inches in size.

5. A culvert or a rock underdrain should be provided in the fill material unless the surface drainage from the valley above the proposed fill area and from the approach roadway and portal area is to be diverted away from the proposed fill area. The rock underdrain, if employed, should be at least 10-ft wide by 4-ft high constructed with clean rock with size ranges from 3 to 30 inches with at least 90% greater than 12 inches, and should be enclosed with a layer of filter fabric, such as Mirafi 140S or equivalent. The culvert should have a capacity to safely pass the peak runoff from a 10-year, 24-hour storm precipitation event.

Prepared by

Julian Liu, Ph.D., P.E.
Sr. Geotechnical Engineer

Larry Migliaccio, P.E.
Director



DWN. JKH
CKD. JSL
DATE. 4-21-81
SCALE. 1"=50'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

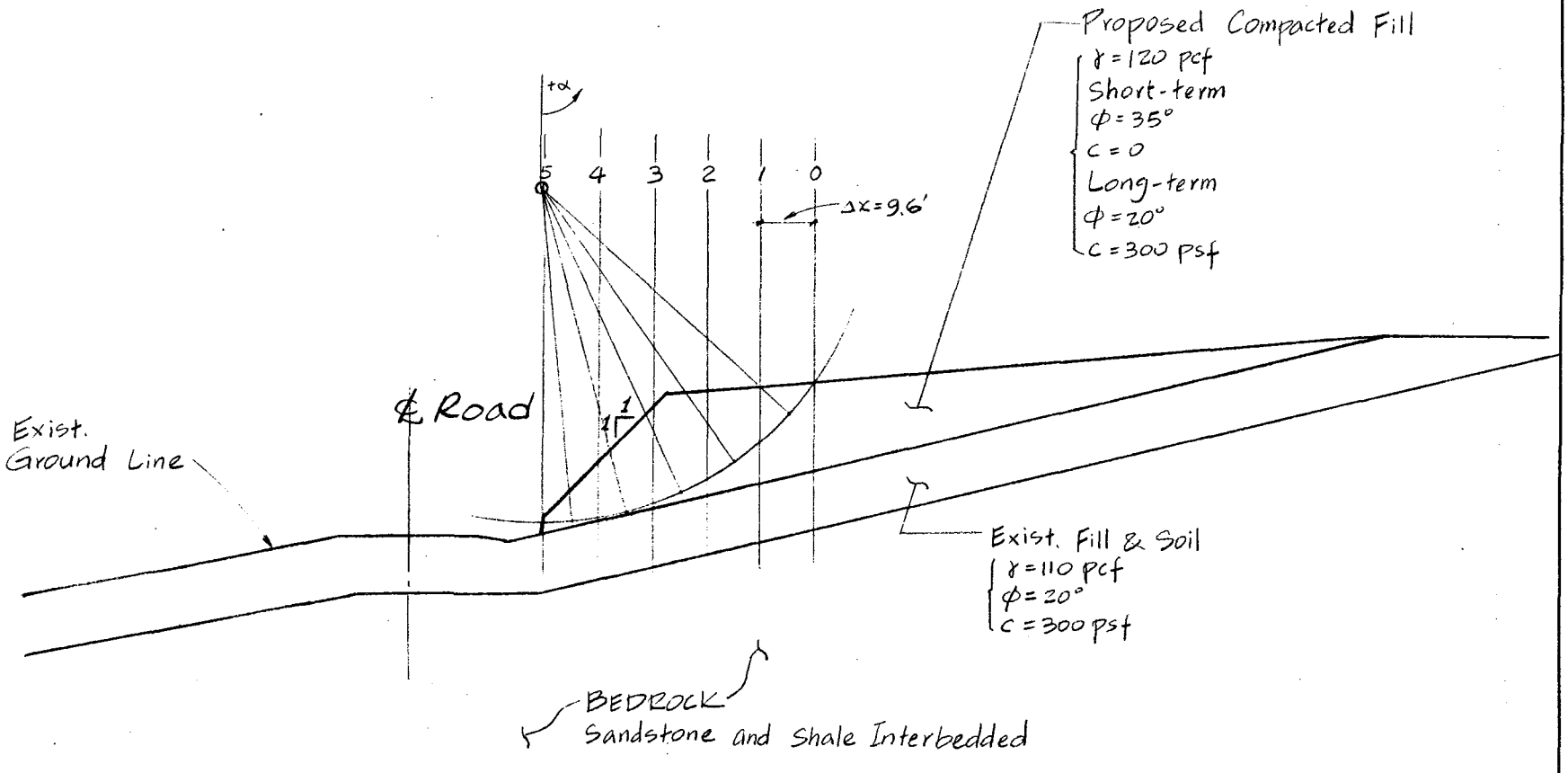
F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 1

DWN.	JKH
CKD.	JSL
DATE.	4-20-81
SCALE.	1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.	
GRID.	
PROJ.NO.	16009
DWG.NO.	2-A



TRIAL NO. 1

DWN. JKH
CKD. JSL
DATE. 4-20-81
SCALE. 1"=30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 2-B

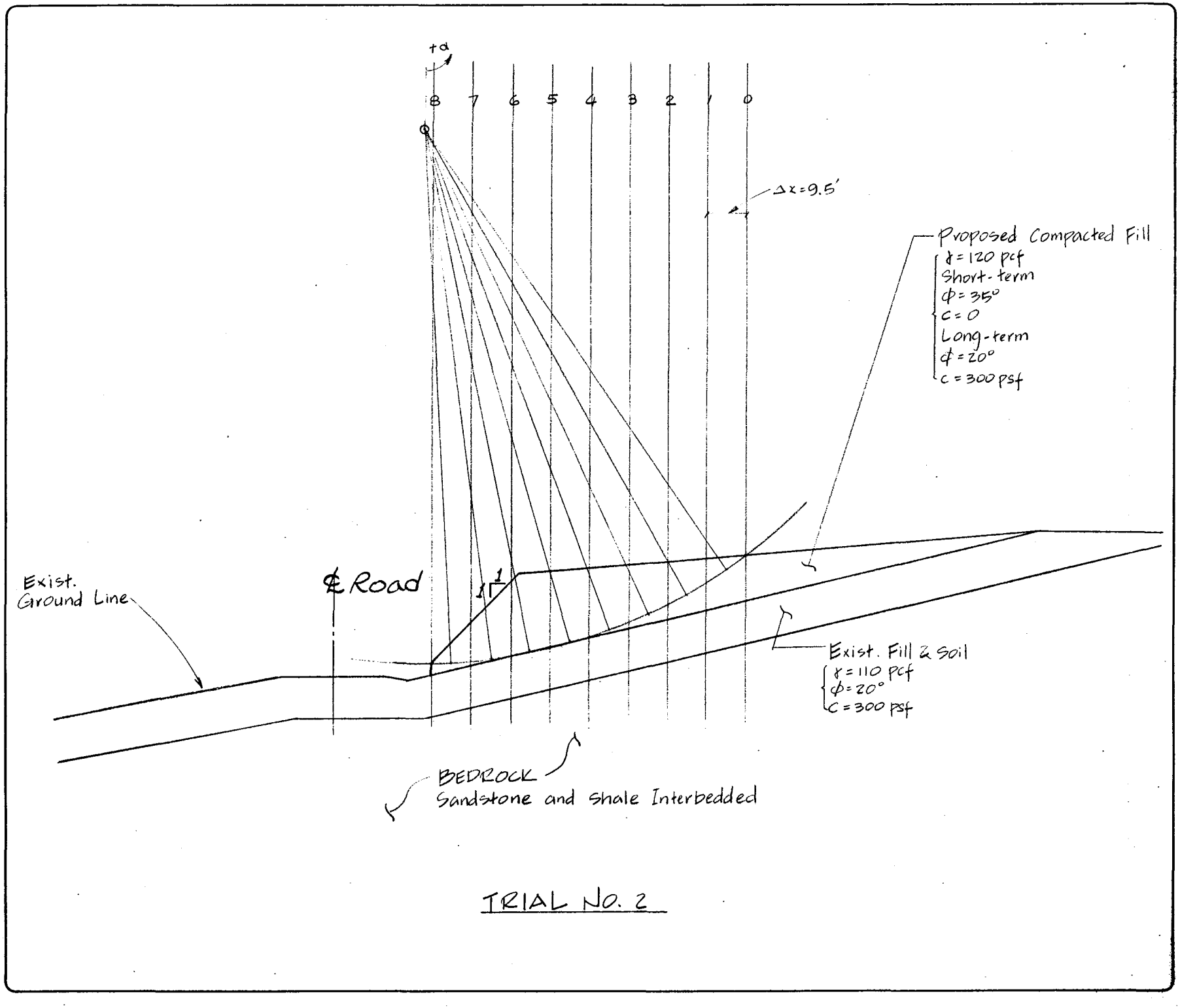
TRIAL NO. 1

						LONG-TERM EFFECT						SHORT-TERM EFFECT			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SLICE	ΔW	α	$\sin\alpha$	ΔT	$\cos\alpha$	C	$C\Delta L$	ΔN	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$	C	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$
0-1	5760	48	0.743	4280	0.669	300	4350	3853	20°	0.364	1402	0	35°	0.700	2697
1-2	14688	35.5	0.581	8534	0.814	↓	3450	11956	↓	↓	4352	↓	↓	↓	8369
2-3	19572	25	0.423	8279	0.906	↓	3150	17732	↓	↓	6454	↓	↓	↓	12412
3-4	15264	15	0.259	3953	0.966	↓	3000	14745	↓	↓	5367	↓	↓	↓	10322
4-5	6336	6	0.105	665	0.995	↓	2850	6304	↓	↓	2295	↓	↓	↓	4413
				25711			16800				19870				38213

LONG-TERM S.F. $= \frac{16800+19870}{25711} = 1.43 \approx 1.5$ Say O.K.

SHORT-TERM S.F. $= \frac{38213}{25711} = 1.49 \approx 1.5$ Say O.K.

Note: All units in ft and pounds.



TRIAL NO. 2

DWN. JKH
CKD. JSL
DATE. 4-20-81
SCALE. 1" = 30'

R&M CONSULTANTS, INC.
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BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 3-A

DWN. JKH
CKD. JSL
DATE. 4-20-91
SCALE. 1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 3-B

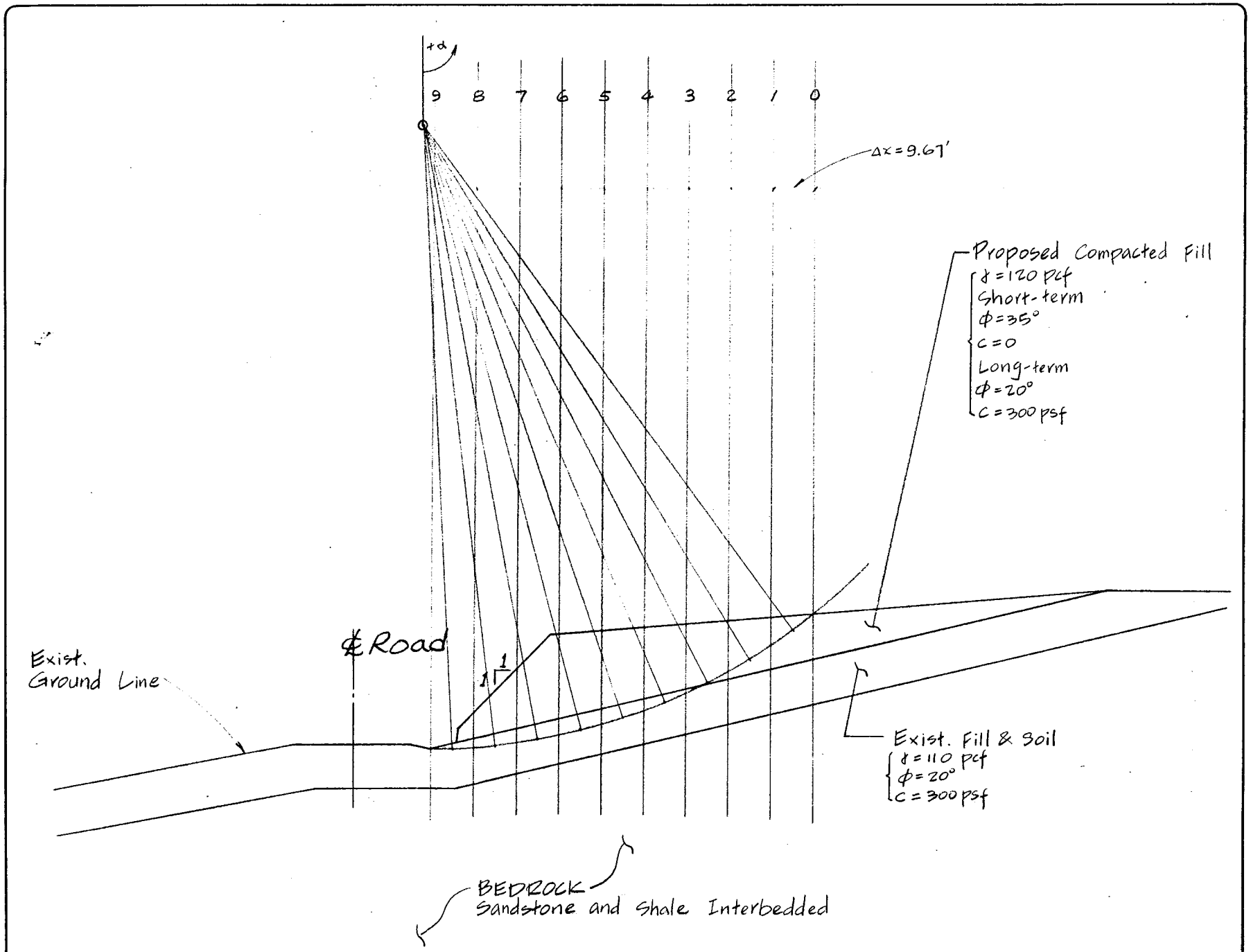
TRIAL NO. 2

						LONG-TERM EFFECT						SHORT-TERM EFFECT			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SLICE	ΔW	α	$\sin\alpha$	ΔT	$\cos\alpha$	C	$C\Delta L$	ΔN	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$	C	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$
0-1	3363	34.5	0.566	1900	0.824	300	3450	2770	20°	0.364	1010	0	35°	0.700	1940
1-2	9348	29.4	0.491	4590	0.871	↓	3150	8140	↓	↓	2960	↓	↓	↓	5700
2-3	13851	24.7	0.418	5790	0.909	↓	3150	12590	↓	↓	4580	↓	↓	↓	8810
3-4	17271	20.2	0.345	5960	0.938	↓	3150	16200	↓	↓	5900	↓	↓	↓	11340
4-5	19950	15.7	0.271	5410	0.963	↓	3000	19210	↓	↓	6990	↓	↓	↓	13450
5-6	21645	11.4	0.198	4290	0.980	↓	2880	21210	↓	↓	7720	↓	↓	↓	14850
6-7	15390	7.3	0.127	1960	0.992	↓	2970	15270	↓	↓	5560	↓	↓	↓	10690
7-8	5415	3.0	0.052	280	0.999	↓	2850	5410	↓	↓	1970	↓	↓	↓	3790
				30180			24600				36690				70570

LONG-TERM S.F. $= \frac{24600 + 36690}{30180} = 2.03 > 1.5$ OK.

SHORT-TERM S.F. $= \frac{70570}{30180} = 2.34 > 1.5$ OK.

Note: All units in ft and pounds.



TRIAL NO. 3

DWN. JKH
CKD. JSL
DATE. 4-20-81
SCALE. 1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 4-A

DWN. JKH
CKD. JSL
DATE. 4-20-91
SCALE. 1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 4-B

TRIAL NO. 3

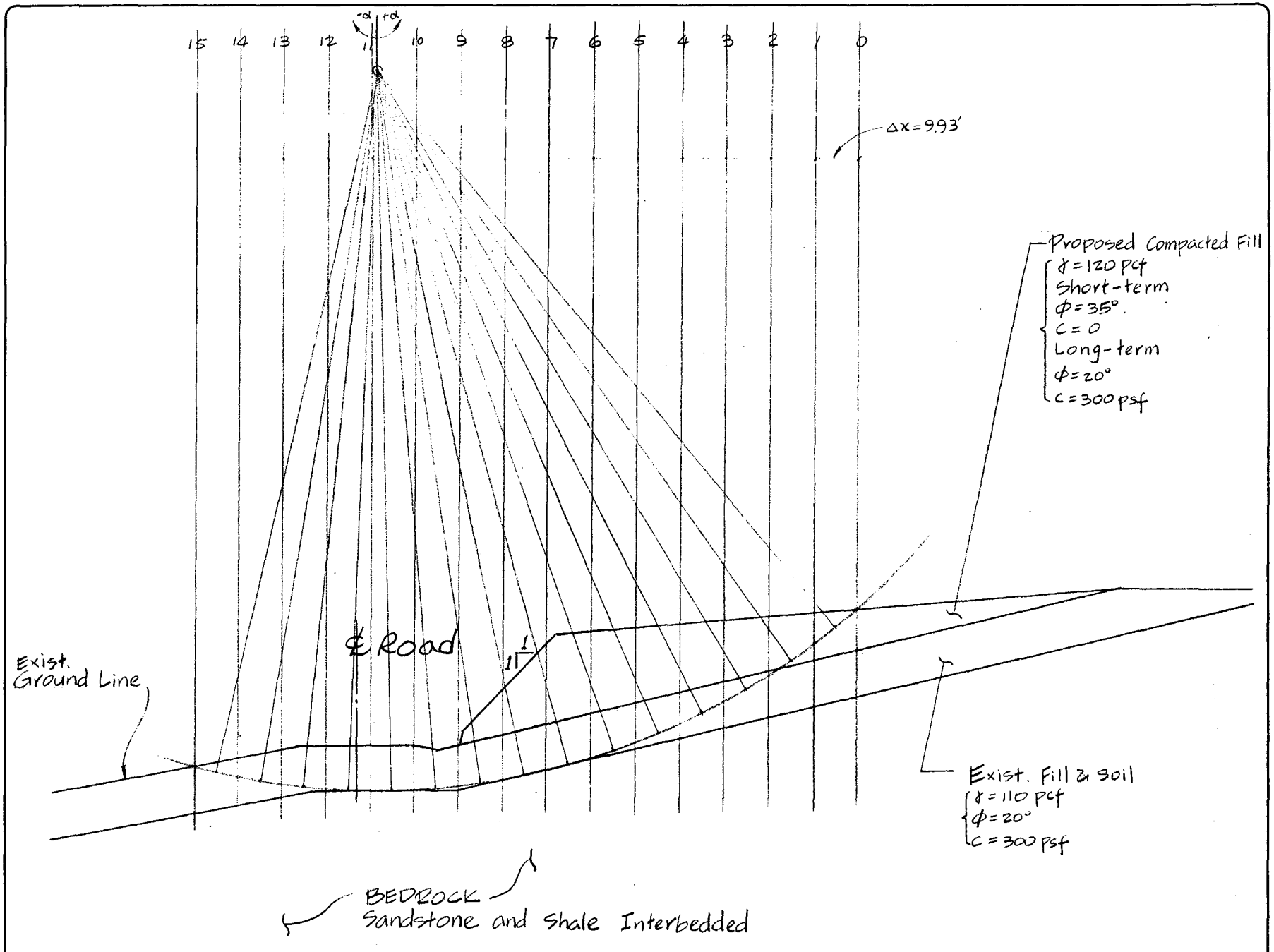
						LONG-TERM EFFECT						SHORT-TERM EFFECT					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SLICE	ΔW	α	$\sin\alpha$	ΔT	$\cos\alpha$	c	cΔL	ΔN	ϕ	Tanϕ	$\Delta N \times$ Tanϕ	c	cΔL	ΔN	ϕ	Tanϕ	$\Delta N \times$ Tanϕ
0-1	3170	36.5	0.595	2240	0.804	300	3510	3030	20°	0.364	1100	0	0	3030	35°	0.700	2120
1-2	10620	31.7	0.525	5580	0.851	↓	3450	9040	↓	↓	3290	↓	↓	9040	↓	↓	6330
2-3	16010	27.4	0.460	7370	0.888	↓	3300	14220	↓	↓	5180	300	1260	14220	* 29°	0.554	7880
3-4	20180	23.1	0.392	7910	0.920	↓	3090	18510	↓	↓	6760	↓	3090	18570	20°	0.364	6760
4-5	23310	19.0	0.326	7600	0.946	↓	3060	22050	↓	↓	8030	↓	3060	22050	↓	↓	8030
5-6	25530	15.1	0.261	6660	0.965	↓	3000	24640	↓	↓	8970	↓	3000	24640	↓	↓	8970
6-7	23130	11.1	0.193	4580	0.981	↓	2910	23280	↓	↓	8470	↓	2910	23280	↓	↓	8470
7-8	13960	7.1	0.124	1730	0.992	↓	2940	13850	↓	↓	5040	↓	2940	13850	↓	↓	5040
8-9	2970	3.2	0.056	170	0.998	↓	2850	2960	↓	↓	1080	↓	2850	2960	↓	↓	1080
				43840			28110				47920		19110				54680

* Weighted average ϕ

$$\text{LONG-TERM S.F.} = \frac{28110+47920}{43840} = 1.73 > 1.5 \text{ O.K.}$$

$$\text{SHORT-TERM S.F.} = \frac{19110+54680}{43840} = 1.68 > 1.5 \text{ O.K.}$$

Note: All units in ft and pounds.



TRIAL NO. 4

DWN. JKH
CKD. JSL
DATE. 4-20-81
SCALE. 1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID.
PROJ.NO. 161009
DWG.NO. 5-A

DWN. JKH
CKD. JSL
DATE. 4-21-81
SCALE 1" = 30'

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

BLAZON MINE
SLOPE STABILITY STUDY

F.B.
GRID
PROJ.NO. 161009
DWG.NO. 5-8

TRIAL NO. 4

						LONG-TERM EFFECT						SHORT-TERM EFFECT					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SLICE	ΔW	α	$\sin\alpha$	ΔT	$\cos\alpha$	c	$c\Delta L$	ΔN	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$	c	$c\Delta L$	ΔN	ϕ	$\tan\phi$	$\Delta N \times \tan\phi$
0-1	4290	39.1	0.631	2710	0.776	300	3660	3330	20°	0.364	1210	0	0	3330	35°	0.700	2330
1-2	12440	34.9	0.572	7120	0.820		3660	10200			3710	300	900	10200	*31°	0.600	6120
2-3	18940	30.7	0.511	9680	0.860		3540	16290			5930		3540	16290	20°	0.364	5930
3-4	24020	26.8	0.451	10830	0.893		3240	21450			7810		3240	21450			7810
4-5	28210	23.1	0.392	11060	0.920		3240	25950			9450		3240	25950			9450
5-6	31590	19.4	0.332	10490	0.943		3150	29190			10840		3150	29190			10840
6-7	34080	15.6	0.269	9170	0.963		3150	32820			11950		3150	32820			11950
7-8	27880	12.0	0.208	5800	0.978		3000	27270			9930		3000	27270			9930
8-9	17950	8.5	0.148	2660	0.989		3000	17750			6460		3000	17750			6460
9-10	9780	4.9	0.085	830	0.996		3000	9740			3550		3000	9740			3550
10-11	11090	1.2	0.021	230	1.000		2940	11090			4040		2940	11090			4040
11-12	11090	-2.2	-0.038	-420	0.999		3000	11080			4030		3000	11080			4030
12-13	10050	-5.8	-0.101	-1020	0.995		3000	10000			3640		3000	10000			3640
13-14	6450	-9.1	-0.158	-1020	0.987		3000	6370			2320		3000	6370			2320
14-15	2190	-12.8	-0.222	-490	0.975	↓	3000	2140	↓	↓	780	↓	3000	2140	↓	↓	780
				67630			47580				85650		41160				89180

*Weighted average ϕ

$$\text{LONG-TERM S.F.} = \frac{47580+85650}{67630} = 1.97 > 1.5 \text{ O.K.}$$

$$\text{SHORT-TERM S.F.} = \frac{41160+89180}{67630} = 1.93 > 1.5 \text{ O.K.}$$

Note: All units in ft and pounds.

Blazon no.1 Mine

Drainage Study

prepared for
Sanders & Assoc.

Land Group Engineering
Engineers, Land Surveyors
suite 304, 205 W. 7th So. Salt Lake City, Utah

TABLE OF CONTENTS

ABSTRACT

A drainage study of the area surrounding the Blazon No. 1 Mine in Carbon County, Utah was done for Sanders and Associates. The results of that study are presented in this report.

July 26, 1979

STORM DRAINAGE STUDY FOR THE BLAZON NO. 1 MINE

Introduction

This report represents a study of the storm runoff and the proposed methods of controlling the runoff that passes through the Blazon No. 1 Mine site in Carbon County, Utah. Storm drainage from the site itself is also discussed.

Methods

The method used for calculating storm runoff is the "Rational Method", $Q = CiA$, where Q = storm runoff in cubic feet per second (cfs), C = coefficient of imperviousness, i= intensity of rainfall in inches per hour (in/hr), and A = contributing area in acres. This formula assumes that the maximum rate of runoff for a given intensity occurs when all parts of the drainage area are contributing. The values used for the various factors were obtained through the use of topography maps, study of the soils and vegetation, and statistics of local weather.

The coefficient of imperviousness used was 0.20. Although the terrain is fairly steep, the soils are moderately pervious, with some vegetation. The values for the rainfall intensity are based upon 10-year and 100-year return periods, with times of concentration, t_c, of 49 minutes and 45 minutes for areas A and B, respectively (see topography map, Appendix B). The time of concentration is based upon the distance between the most distant point and the design point, the difference in elevation between these points,

and the characteristics of the surface over which the water flows.

The contributing drainage area sizes are 2,131 acres and 1,245 acres for areas A and B, respectively. Snowmelt was calculated using a 260" snowpack at 10% moisture content with 75% runoff in a two and a half week period. These conditions approximate a 10 year storm. Using a coefficient of imperviousness of 0.80 yields the following:

$$\frac{\frac{260 \text{ in}}{12 \text{ in/ft}} \times 0.10 \times 2131A \times 43560 \text{ ft}^2/A}{18 \text{ days} \times \frac{24 \text{ hrs}}{\text{day}} \times \frac{3600 \text{ sec}}{\text{hr}}} = 129 \text{ cfs}$$

$$129 \text{ cfs} \times 0.75 \quad 0.80 = \underline{78 \text{ cfs}}$$

However, the runoff from area A for the 10 year - 49 minute storm is a much higher flow although much less total volume:

$$Q = (0.20)(0.74 \text{ in/hr})(2131 \text{ acres}) = \underline{315 \text{ cfs}}$$

This would require approximately an 84" diameter culvert. The recommended alternative is to use a 42" diameter pipe (with a capacity of 80 cfs at a 12 foot head) and a detention pond with a capacity of 650,000 cf (see drawing 2, Appendix B). The details of the dam are shown on drawing 3.

The 100 year - 24 hour storm at 65 cfs would be carried easily. The 1000 year - 24 hour storm at 85 cfs would also be carried with very little detention time.

The culvert carrying the Long Canyon (area B) flow was sized to carry the 10 year - 24 storm:

$$Q = (0.20)(0.10 \text{ in/hr})(1245 \text{ acres}) = \underline{25 \text{ cfs}}$$

This flow would require a 33 inch culvert with the down-stream bank of the road being protected with rip rap for the larger storm runoff overflow.

On site runoff is to be routed through a sedimentation pond system as shown on the site map (drawing 2). The details of the system are shown on drawing 3. The system is designed to carry the flow of a 10 year - 5 minute storm:

$$Q = (0.60)(2.3 \text{ in/hr})(0.9 \text{ acre}) = \underline{1.24 \text{ cfs}}$$

The size of each pond was determined using a 10 year - 24 hour storm and a detention time of eight hours.

$$Q = (0.60)(0.10 \text{ in/hr})(0.9 \text{ acre}) = \underline{0.054 \text{ cfs}}$$

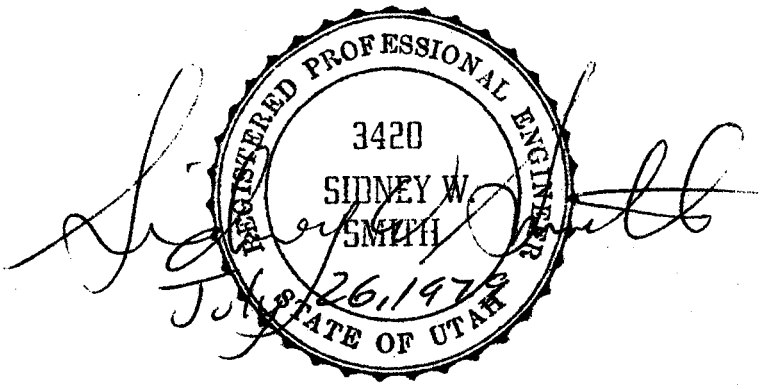
$$\text{Vol} = Qt = 0.054 \text{ cfs} \times 8 \text{ hrs} \times 3600 \text{ sec/hr} = \underline{1555 \text{ cf}}$$

The inlet-outlet structures and transfer structure between the ponds are designed to minimize short circuiting with wiers in the ponds being designed to prevent any floating material such as oil from contaminating the effluent. The eight hour dentention time should be adequate to settle out all suspended solids.

Before any construction in the area is begun, a silt fence should be installed across Mud Creek at the location shown on the site map. The fence will retain any material that the stream picks up as it flows through the construction area. See drawing 3 for the silt fence details.

Conclusion

The storm runoff will be adequately controlled with little danger of flooding and the effects of the mining operation on the natural stream flow and water quality should be minimized.



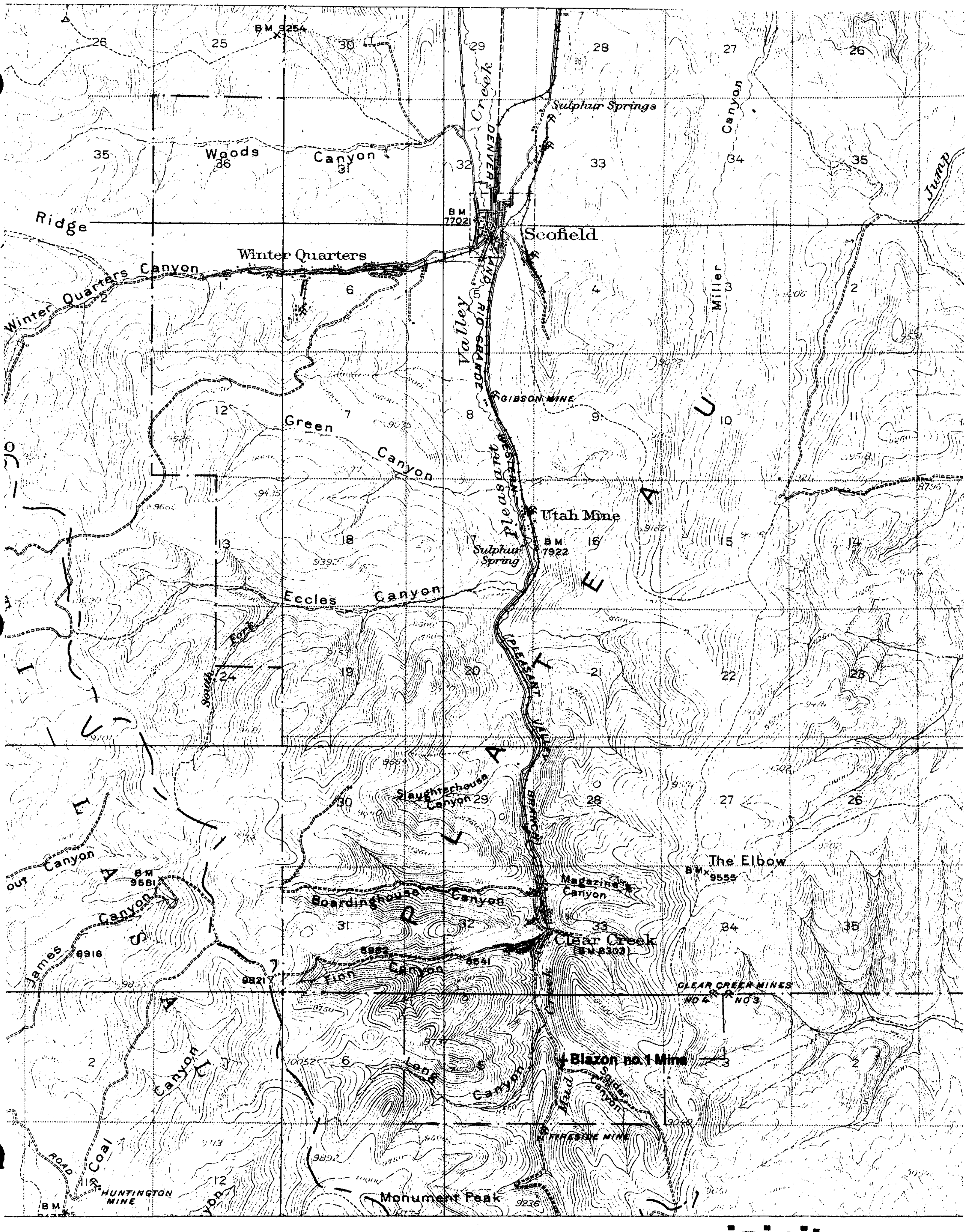
APPENDIX A

TABLE I

RUNOFF CALCULATIONS

AREA	STORM	C	i (in/hr)	A (acres)	Q (cfs)	CULVERT SIZE (Dia. in inches)
A	10 yr-49 min	0.20	0.74	2131	315	84
	10 yr-24 hr	0.20	0.10	2131	43	36
	100 yr-24 hr	0.20	0.15	2131	65	42
	1000 yr-24 hr	0.20	0.20	2131	85	48
	260" snowpack	0.80	n/a	2131	78	42
B	10 yr-45 min	0.20	0.77	1245	192	72
	10 yr-24 hr	0.20	0.10	1245	25	33
	100 yr-24 hr	0.20	0.15	1245	37	36
	1000 yr-24 hr	0.20	0.20	1245	50	42
	260" snowpack	0.80	n/a	1245	45	36

APPENDIX B



vicinity map